Service Manual

STAT PROFILE®

pHOx®

nova biomedical

Stat Profile® pHOx® Service Manual

Part Number and Ordering Information

The *Stat Profile® pHOx® Service Manual* (PN 24301) can be ordered from Nova Biomedical Order Services. Write or call:

Nova Biomedical
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1.0 Introduction

This manual contains information and procedures used in servicing the Stat Profile pHOx Analyzer. The intent is to supplement the information provided in the Stat Profile pHOx Instructions for Use Manual (PN 37865) and the Stat Profile pHOx Advanced User Applications Manual (PN 35235). This manual does not supersede any current performance specification claims, expendable maintenance procedures, or warranty criteria as outlined in the reference manual.

1.1 The Stat Profile pHOx Analyzer

1.1.1 Environmental

Ambient Temperature:	15° - 32° C (59° - 86° F)
Ambient Humidity:	0% - 95% Non-condensing

1.1.2 Energy consumption

Air Conditioning Load:	Peak 44 BTU/Hour
Power Consumption:	~130 watts peak
Power requirements:	100-120; 230-240 VAC, 50/60 Hz

- 2 Amp Time Delay (SB 2A or T2A) at 100-120VAC line
- 1 Amp Time Delay (T1A) at 220-240 VAC line

1.1.3 Physical Dimensions

Weight:	8.1 Kg (18 lbs)
Dimensions:	38 cm high (15 in) x 31 cm (12 in) wide x 38 cm (15 in) depth

1.1.4 Regulatory Compliance

The analyzer is tested and acceptable to attach the CSA, GS (Europe), JIS (Japan), and CE (self declaration) safety marks, and compliant with EN1010-1, EN55011, and IEC 801-2.

1.1.5 Location - Stable stationary surface.

- 8 cm (3 in) clearance to a wall or adjacent instrumentation
- Not intended for use on vibrating (helicopter, etc.) surface
- Placement on a cart is acceptable if the cart is stationary during operation.

1.1.6 Operational

The analyzer is designed to be on at all times. It may be turned off without special procedure or consideration for up to 1 hour with no detrimental effect on the sensors or fluidics.

The tubing should be flushed and the pump tubing relaxed prior to extended shutdown periods.

Any shutdown period will require a 2-point calibration and verification by control material upon restarting operation.

1.1.7 General

The analyzer utilizes an Intel 386EX processor, PCMCIA ROM programming.

There are three RS-232 connectors, utilizing ASTM protocol, and one Bar Code reader connection.

The display is a backlit liquid crystal (LCD) with type that is CCFT backlit with 320 x 240 pixel resolution.

The internal optional printer is a 20 column thermal international font /166 dot graphics printer with ~5 cm (2 in) wide paper.

NOTE: *The circuit boards use fine pitch surface mount technology. Field repair of these circuit boards is not possible. DO NOT attempt to repair any components on the board.*

1.2 Cautions and Hazards

There are NO user serviceable assemblies inside the analyzer. Only a trained, authorized service representative should remove the cover of this analyzer.

WARNING: *Removal of the top cover allows access to power supply voltages. Care should be taken to avoid electrical shock. Remove the power cord prior to accessing any internal assemblies.*

WARNING: ***Blood samples and blood products are potential sources of hepatitis and other infectious agents. Handle all blood products and flow path components (waste-line, capillary adapter, probe, sensor module, etc.) with care. Gloves and protective clothing are recommended.***

NOTE: *This International Caution Label appears on the rear of the pHOx Analyzer and means refer to the manual.*

It is the responsibility of the service representative to decontaminate any assembly or analyzer being returned to Nova for repair or warranty claim.

Decontamination of external surface of the flow path may be accomplished by a wipe down with cleaning agent or 10% bleach solution.

The Internal surfaces of the flow path and tubing should always be considered contaminated. Prior to removal from the analyzer, ensure that the flow path and tubing are emptied.

WARNING: *Internal surfaces may have sharp edges. Care should be taken to avoid cuts and scrapes when accessing internal assemblies.*

Used tubing, biosensors, electrodes, reagents, controls, etc. may be disposed by normal laboratory waste procedures.

1.3 Required tools

The analyzer is designed to require no unique or special tools. Flow path cleaning wires/kits are provided in the accessory kit. Avoid metal wires or other material that may scratch the internal surfaces of the flow path.

- Digital Volt Meter (2 decimal accuracy)
- Phillips® screwdriver (crosshead) preferably one with 15 cm (6 in) shank
- Spring clip expander wrench or comparable means of releasing tension of retention clips
- Pliers - needle nose or small snub nose

2.0 Product Description

The pHOx analyzer accepts syringe or capillary samples through a sample probe. The operator selects the sample mode via the keypad. The probe moves from its home position in the analyzer to an extended 45° position for syringe sampling. If the capillary sample is selected, the probe moves to a horizontal position that is back inside the capillary adapter.

2.1 Mechanical Assemblies

The analyzer is designed to calibrate using calibration standards and reference solution contained in a reagent pack. The tubing automatically connects with the pHOx when the pack is placed into the analyzer. Likewise, a space is provided for a plug-in control pack. The content and serial number of the pack is coded in a “Dallas Semiconductor Add-Only Memory,” which is read by a One-Wire MicroLAN® system. The analyzer has 4 major mechanical assemblies to move calibrator or sample in front of the biosensors.

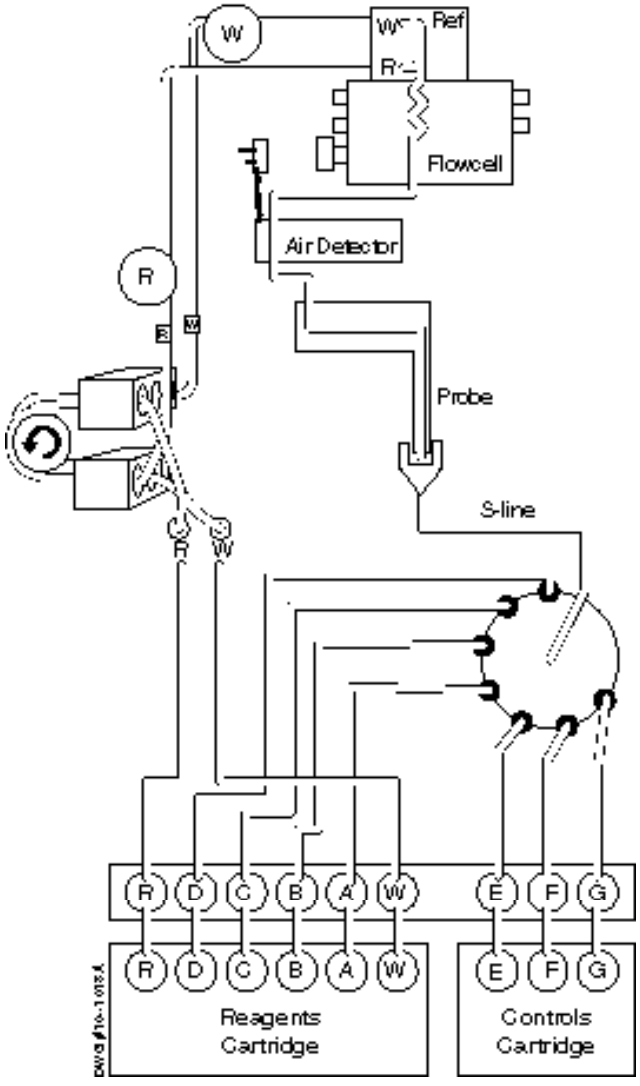


Figure 2-1 Flow Diagram

2.1.1 Pump

The analyzer uses one pump (PN 21492) for 2 functions. The pump aspirates either sample or calibration standards from the sample probe, through the sensor module/reference electrode, through a solenoid actuated pinch valve, and delivers to the waste bottle of the reagent pack.

The second function of the pump is to aspirate the reference solution from the reagent pack and deliver it to the reference electrode through a solenoid actuated pinch valve.

2.1.2 Sampler Assembly

The sampler assembly (PN 21504) utilizes a probe that rotates to 1 of 3 possible positions. The HOME position is vertical with the tip of the probe seated against a "Fluid Fountain" assembly that is the common port of the rotary valve.

The syringe position is the probe tip extended out in front of the analyzer at approximately a 45° angle. The capillary position is horizontal, but the tip is totally inside the capillary adapter. This allows the capillary to be used without a separate adapter. (This position is also used to change the capillary adapter.)

The capillary adapter is pushed onto the end of the sampler. Extending the probe outward from the capillary position ensures that the probe will be seated inside of the adapter. The sampler will exert enough force to push the adapter off of the sampler if it is not aligned correctly.

2.1.3 Rotary Valve Assembly

The rotary valve assembly (PN 22215) has one common port connected to the sampler's fluid fountain. Each calibration standard and quality control standard is connected to a port on the rotary valve. The rotor positions a central port connecting one of the fluids to the outlet port. The outlet port is connected to the Fluid Fountain by the S-Line. Starting the pump aspirates the selected fluid into the flow path.

The rotary valve's manifold also has positions that allow air to enter the S-line. Refer to the replacement procedures for actual positions.

2.1.4 Sensor Module Assembly

The Sensor Module Assembly contains the measuring sensors, flow cell, and preheater. The measuring sensors clip into place upon insertion. The sensors have contacts instead of cabled connectors. When mounted, the sensor module forces the sensor contacts to align with the matching contacts on the left/right interconnect boards. The module also contains the light sources and detector for the SO_2% channel and 2 air detectors.

Please refer to the drawing section and Appendix A for individual part numbers.

2.2 Electronic Assemblies.

2.2.1 Power Entry Module

The power entry module (PN 22818) provides the interconnect to wall power. The fuses are found in the accessory kit for the operating voltage (120 VAC PN 22814, 236 VAC PN 22817). The power entry module connects to the power supply through TB1.

2.2.2 Power Supply

The power supply (PN 21602) provides all of the power requirements for the analyzer. The analog and logic voltage used in the pHOx are **± 5VDC. The stepper motors are driven by +24 VDC.** This module has no repairable parts inside. The power supply connects to the digital control board by TB2.

2.2.3 Digital Control Board

There are 2 Digital Control Boards: all units with monochromatic display use PN 24292, and all units with a color display use PN 40797. The main controlling board of the analyzer uses an Intel 386X processor with the following integrated peripheral functions:

- Clock and Power Management unit
- Watchdog Timer Circuit
- Asynchronous Serial I/O unit
- Synchronous Serial I/O unit
- Parallel I/O unit
- Refresh control unit
- JTAG- Complaint Test Logic Unit

The digital control board provides one 72 pin socket for a 4 MB SIMM module of RAM. This volatile memory stores the calibration, slope, and millivolt data.

Major circuit identification:

U25 is the main clock generator; it is crystal controlled 14.318 MHz and a phase-locked-loop frequency generator. This generates a 50.11 MHz CPU clock, 14.318 MHz for VGA video timing, and 1.84 MHz for Baud rate generation.

U35 is the real time clock containing a battery which will retain the date/time, setup options, daily QC (up to 144 points), Error log (last 96 errors FIFO), and sample counter data. The battery has an expected 10 year life.

U37 PEROM stores the monthly (256 data points) and YTD QC data, QC setup information, and recognition of the QC fluid pack presence.

PCMCIA contains the operational program and boot program. This card must be in place for the unit to function.

U43 is the video control chip. U26 controls the printer output and the I/O ports Comm 1 and Comm 2. U36 is the DUART that controls the Comm 3 I/O port.

U16 provides the serial interface for the (RMS) interface and fluid pack memories.

The mechanical devices are controlled by U18. The Keypad and “home” sensors for the rotary valve and sampler are ported through U18. The stepper motors are 4 phase stepper motors. U18 controls the speed and direction each phase is powered. U3 and U4 provide the power for each winding of the pump motor. U5 and U6 power each phase winding of the sampler motor. U7 and U8 power each phase of the rotary valve motor.

U18 also provides the logic signal to operate the other mechanical devices. Typically, the devices are connected to either 12 VDC or 24 VDC and the logic provides a ground path through a transistor. The waste valve solenoid (12 VDC) grounds through Q3, the reference solenoid (12 VDC) through Q4, the sensor module lamp (24 VDC) through Q6, and the preheater (24 VDC) through Q2. The 24 VDC valve boost circuit is on the board but not used on the pHOx analyzer.

Power is received from the power supply through the J7 connector on the digital control board.

Power Supply Connector TB2

1	2	3	4	5	6	7	8
+12 VDC.	-12 VDC	+24 VDC.	Ground	Ground	Ground	+5 VDC	+5 VDC

Digital Board Connector J7

Pin 1	2	3	4	5	6	7	8
Ground	+24 VDC.	+5 VDC	+5 VDC	Ground	+12 VDC.	Ground	-12 VDC

Sensing

Wire Color

Black	Violet	White	Red	Black	Orange	Green	Yellow

Individual circuits are protected from an over current condition by the use of Positive Temperature Coefficient Resistors (PTC). These resistors act as a direct short if the current is below a set current. If the current increases, the resistors heat up and open, similar to a fuse. When the device cools off, the connection is remade, allowing the circuit to function. The following lists these devices:

R22 - Solenoid common boost circuit (not used on pHOx)
R24 - Heater power circuit
R29 - Printer motor power
R43 - Print Head heater power
R44 - +24 VDC
R45 - +5 VDC
R71 - Bar Code Reader (+5 VDC out)
R249 - Distribution board power (This board is mounted in the door.)

The LED indicators on this board are mostly unused. All will light at power up and then go off. The exception is D8 - 100 Hz Clock. D9 - 386 Strobe will appear to be always on. D7 is your program fail indicator and will come on with a software reset.

Connectors:

J1 Bar Code Reader
J2 COMM 1
J3 COMM 2
J4 COMM 3
J5 JTAG
J6 PCMCIA
J7 Power Supply
J8 Mechanical Assemblies
J9 Printer Connector
J10 Analog Board J11 - Display/Keypad (Motors/heater/lamp/solenoids and door)

2.2.4 Analog Board

There are 2 Analog Boards: pHOx, pHOx Basic, BiopHOx use PN 24291 and pHOx Plus, pHOx Plus L, and pHOx Plus C use PN 33390. U34 is the microprocessor that controls the signal acquisition and digital conversion. The signals are connected through several connectors.

- Left Sensor Interface board J6 - PCO_2, pH, Reference, Air Detector (ADT) 4
- Right Sensor Interface board J7 - PO_2, Na^+
- Sensor module J4 - SO_2% detector, Preheater temp, ADT2, ADT3/Hct
- Mechanical assemblies J3 - ADT1

Barometric pressure sensor U9 is on the analog board. The Analog to Digital Conversion (ADC) is performed by U31. The signals are multiplexed through U26 and U32.

Preheater temperature control circuits are on the analog board. +24 VDC are ported through J3 to the SO_2%/sensor module board (J4). The heater power wiring is protected on the digital control board by a PTC Resistor; the Heater has an in line thermostat (50°C) in the sensor module. The thermistor has 18.25 Kohms resistance at 37°C. The signal will change at a rate of 22.5 millivolts/0.1°C.

There are 4 ADTs in the system. ADT1 holds the sample probe (40 uL setting). ADT2 at the inlet to the sensor module (70 uL). ADT3 is at the input to the sensors and is also used for the Hct. ADT4 is in the reference electrode housing.

Logic and analog power is supplied to the analog board from the digital control board. Logic voltage (+5 VDC) enters J1 pin 14. The analog +5 VDC enter J1 pin 3 and -5 VDC J1 pin 4. The analog board provides power to the SO_2 board through +5 VDC J4 pin 5 and -5 VDC J4 pin 6.

2.2.5 SO_2 Control Board

SO_2 Control Board is an integral part of the Sensor module. It controls the 2 LED light sources that glow at 880 nM and 660 nM, respectively.

2.2.6 Electrode Interface Boards

NOTE: *The electrode interface boards are found only on pHOx and pHOx Basic.*

The Electrode Interface Boards have 2 part numbers: PN 20641 (Left) and PN 20674 (Right). The electrodes are wireless. The electrodes have point contacts which engage the Interface board contacts when inserted into the sensor module. The left interface board, connecting to the analog board through J6, has 3 sets of contacts: one set for the reference electrode/ADT4, one set for Na^+, and one set for PCO_2 sensors. The reference electrode/ADT4 has 3 individual point contacts while the Na+ and PCO_2 have 2 individual point contacts.

The right interface board has 2 sets of contacts: one for the pH and one for the PO_2 sensors; each consisting of 2 individual point contacts. This board is connected through J7 to the analog board.

2.2.7 Door Assembly Electronics

The door assembly electronics include the Display Assembly, the Distribution Board, and the Keypad Assembly. The digital control board sends/receives signals to the door via the flat cable J104 on the distribution board.

NOTE: *See Section 3.13 for part numbers that are model specific.*

The keypad, which is glued onto the door, connects to the distribution board via J102 and has a ground cable clamped to the conductive surface on the inside of the door. The Analyze key also connects to the distribution board through this connector.

The distribution board also provides the signal path to the display assembly and power to the display back lighting lamp. The display is a liquid crystal, graphics display. It has a 320 x 240 dot matrix (1/4 VGA) yielding a 122 x 92 mm (4.99 x 1.33 inch) viewing area. This translates to a 40 x 20 character display using a standard character set. The display is backlit by cold cathode fluorescent tube (CCFT).

An 8 ohm voice coil loudspeaker is mounted on the distribution board, producing all associated sounds.

3.0 Replacement Procedures

CAUTION: *Assemblies may have loose hardware mounting. Ensure no loose hardware is left in the unit before restoring power to the analyzer.*

WARNING: *Removal of the analyzer cover will allow access to line voltage wiring. Power should be turned off and the power cord disconnected before any assembly replacement procedure is performed.*

3.1 Cover Removal

1. Turn the unit OFF, disconnect the line cord, and have the back of the unit facing you.
2. Remove the 4 rear-panel-corner-mounting screws. Lift the printer cover and remove the 2 cover mounting screws.
3. Slightly spread the bottom sides and slide the cover toward the back. This will disengage the internal clips at the front of the cover.
4. Lift the cover off the unit. Take care not to damage any cables or wiring during removal.

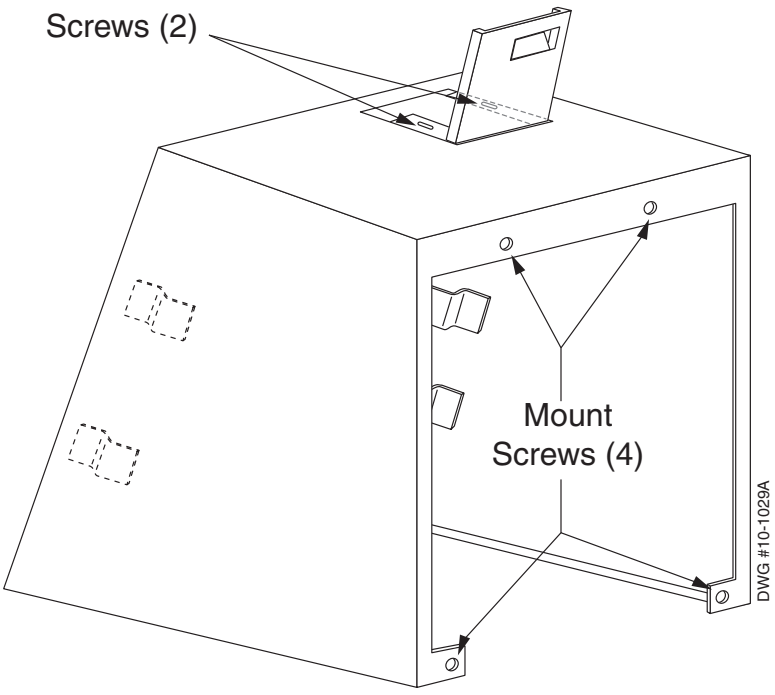


Figure 3-1 Cover Removal

3.2 Tubing Harness

1. Remove the analyzer cover per Section 3.1.
2. Remove the digital control shield. There are 4 mounting screws:
   One at the top front
   One at the bottom front
   Two at the bottom rear (above and below the PCMCIA card)

NOTE: *Take care not to lose the spacers on the screws.*

NOTE: *It is optional to remove the digital control board and mount plate when accessing the reference and waste line. To remove the digital control board and mount plate, follow these steps:*

a. *Disconnect the electrical connectors (J7, J8, J9, and J10) from the top of the board.*

b. *Disconnect J11 connector at the bottom front of the board.*

c. *The digital control board and mount plate come off as one assembly. There are 3 mounting screws: two on the rear panel and one at the top front on the printer box. (Take care not to damage the board.)*

d. *Slightly lift the board and mount plate upward and out from the side of the analyzer.*

e. *Remove the ground strap on the back of the board.*

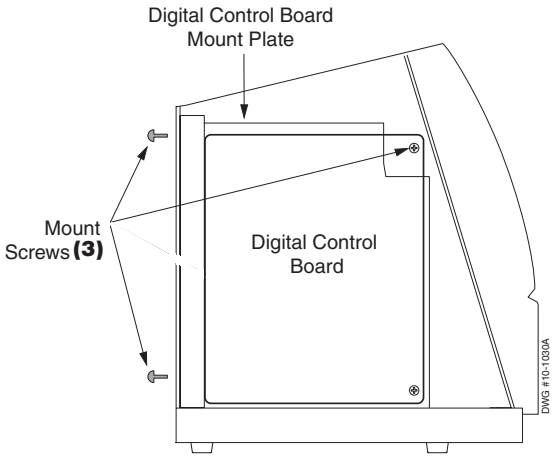


Figure 3-2 Removing the Digital Control Board/Mount Plate

3. Remove the R and W-lines from their front panel fitting. (Looking at the front panel, R is on the left.) If you have not removed the digital control board, it may be easier to remove the panel fitting nut on the front panel and move the fitting to the new tubing.

4. Carefully remove the tubing from the rotary valve including the center port to fluid fountain.

NOTE: *Take care not to damage the valve ports. Push the tubing end off the port to reduce the risk of damaging the valve.*

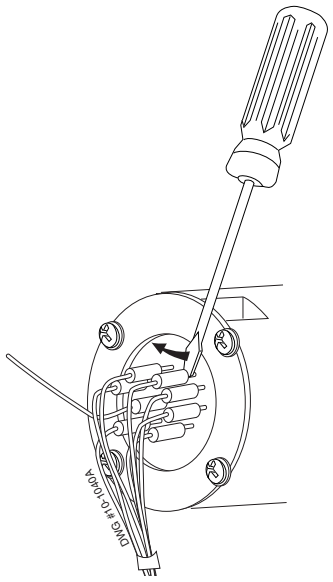


Figure 3-3 Removing Tubing from Rotary Valve

5. The tubing bracket is held in place on each end by a screw. Two screws hold the bracket in alignment; access them from the bottom of the analyzer. Remove both screws.
6. Lift the bracket and tubing set, removing it from the sampler side of the analyzer.
7. Slide the new assembly into the analyzer and reconnect the W and R-tubing to the front panel ports. Ensure that they go to the correct ports and brackets.
8. Reinstall the 2 mount screws at the bottom of the analyzer and the 2 end mount screws.
9. Place the reagent tubing and S-line onto their ports on the rotary valve. Take care that the metal ports are not damaged.

NOTE: *The A line connects at the lower left (7 O'clock position).*

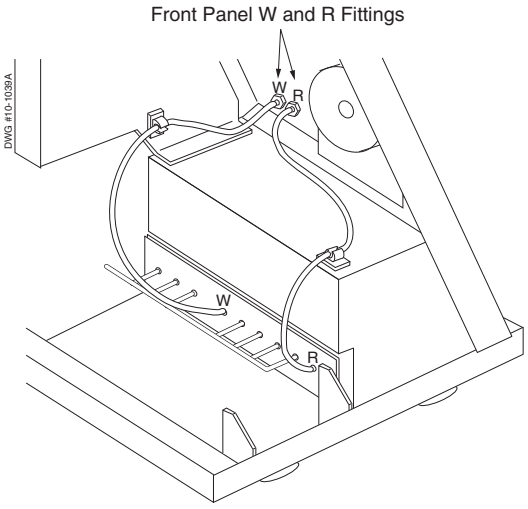


Figure 3-4 Reconnect W and R-lines

10. If the control board and mount plate were removed, replace them.
11. Reinstall the cover and restore the unit to operation.

3.3 Power Supply Removal

The Power Supply (PN 24720) is removed as follows:

WARNING: *Unplug the Analyzer before proceeding.*

1. Remove the analyzer cover per Section 3.1.
2. Disconnect the power harness connectors: P1 and P3 (top of the power supply assembly).
3. Remove the 4 power supply mounting screws from the rear analyzer panel.

NOTE: *Support the power supply before removing the mounting screw.*

4. Carefully lower the supply. Rotate it to access the line input module wiring (TB1) on the bottom of the power supply.

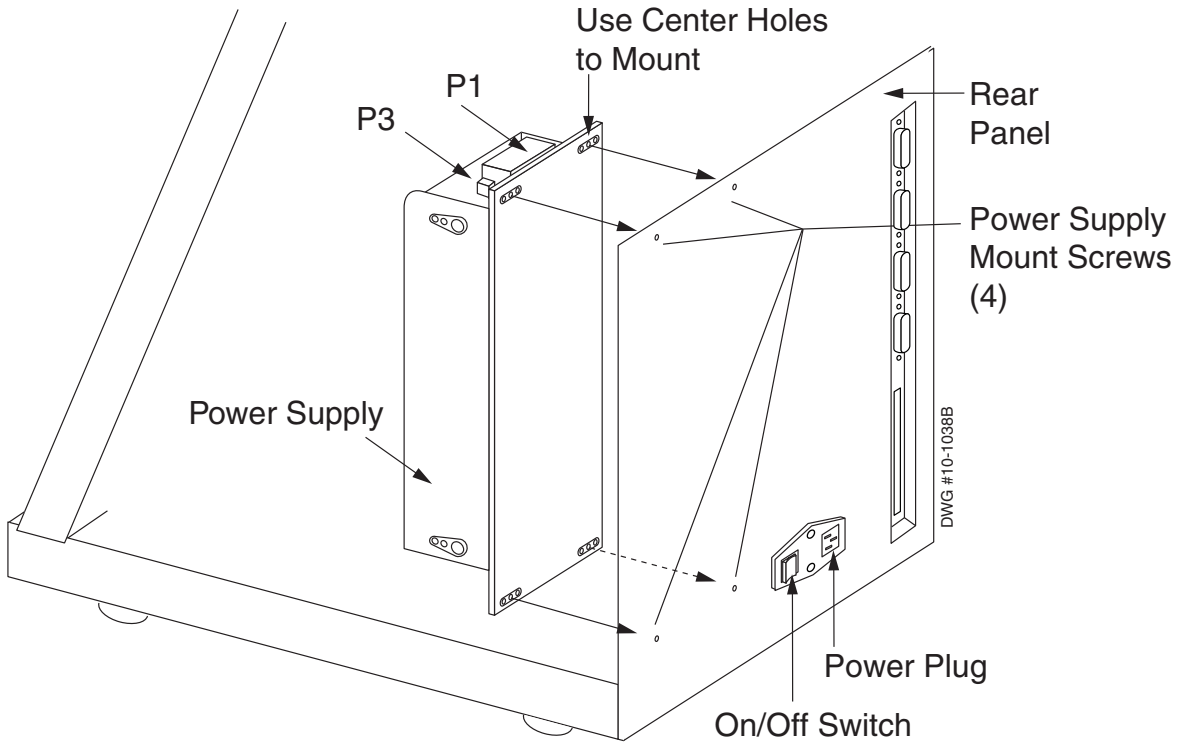


Figure 3-5 Power Supply Removal

5. Disconnect TB1 and remove the power supply.
6. Position the new power supply with the lower side toward the analyzer. Plug in TB1.

NOTE: *TB1 male end has 3 wires. The female end has 5 sockets. The Green/Yellow wire is closest to you.*

7. Position the new power supply to align with the mounting holes in the back panel.

NOTE: *The holes closest to the middle of the supply bracket are the ones used to mount the supply.*

8. Connect P1 and P3.

NOTE: *The wires leave the top of P1. The white wire of P3 goes to the digital display board P7.*

9. Reinstall the unit cover and power cord.

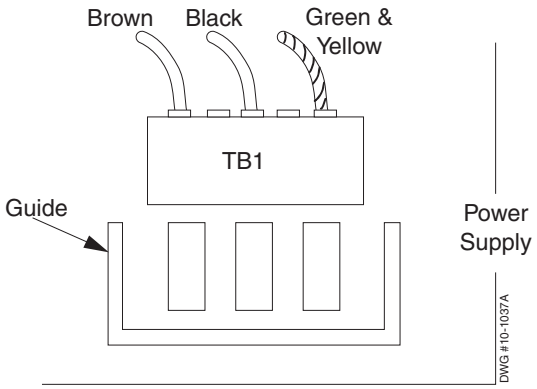


Figure 3-6 Power Supply Position

3.4 Sampler Assembly

The Sampler Assembly (PN 23899) is removed as follows:

1. Remove the probe and the air detector.
   a. From the Menu screen, select Flowpath/Probe Maintenance and press Enter.
   b. Press Move Probe (soft key). Open the door.
   c. Remove the capillary adapter from the front of the probe by gently pulling it off.
   d. Disconnect the air detector's sample line from the sensor module.
   e. Disconnect the 2-prong cable.
   f. Push the air detector down and pull the air detector with the probe out of the sampler assembly.

WARNING: *Unplug the Analyzer before proceeding.*

2. Remove the analyzer cover per Section 3.1
3. Cut the tie wraps on the rear of this assembly.

NOTE: *Care should be taken to avoid cutting wires.*

4. Disconnect the following connectors:
   - J5 Motor cable connector
   - J10 Home detector
   - P6 door switch cable
   - \- Sensor module light cable
   - \- Ground wire
5. Remove the S-Line from the fluid fountain assembly.

STOP: *There are washers and nuts that are NOT captive. Do not lose any hardware into the unit.*

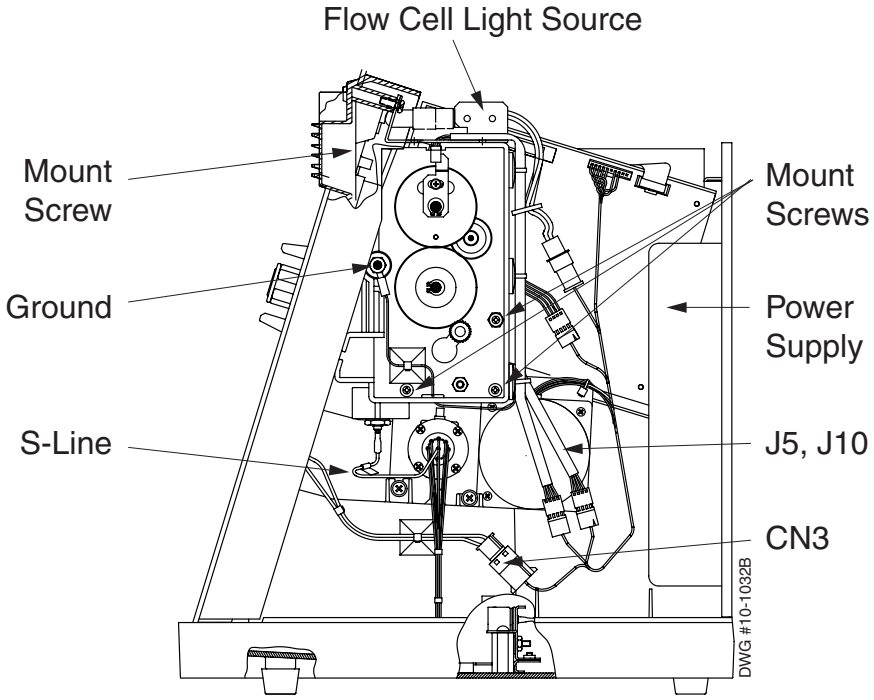


Figure 3-7 Sampler Assembly

6. Remove the 4 mounting screws.
   - One at the sensor module light bracket to front panel
   - One at the lower front of bracket
   - Two at the rear of the sampler bracket, they also mount the rotary valve.
7. If NOT replacing the entire assembly, skip to Step 8, otherwise:
   a. Install the sensor module light bracket onto the new sampler assembly.
   b. Position the new assembly onto the unit. Install the mounting screws and tie wraps.

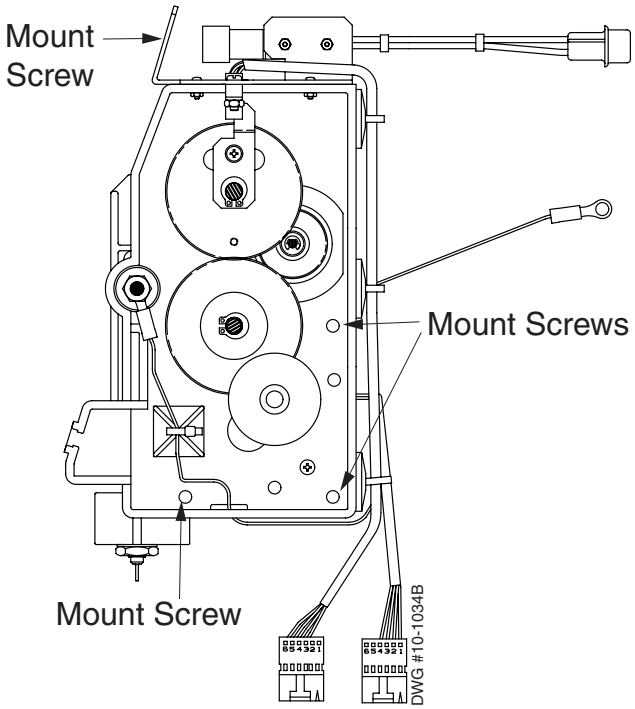


Figure 3-8 Removal of Sampler Assembly

8. Remove sampler subassemblies.
   a. Motor assembly
   1. From the Gear set side of the assembly, remove the flywheel (solid metal disk) by loosening the set screws on its side.
   2. On the motor side remove the 2 mount screws.
   3. Remove the motor (some tie wraps may need cutting). Install the new motor by reversing these steps. Use new tie wraps as required.
   b. Home detector (PN 21504)
   1. Remove the sensor module light and bracket.

NOTE: *Touching the light glass will shorten use life.*

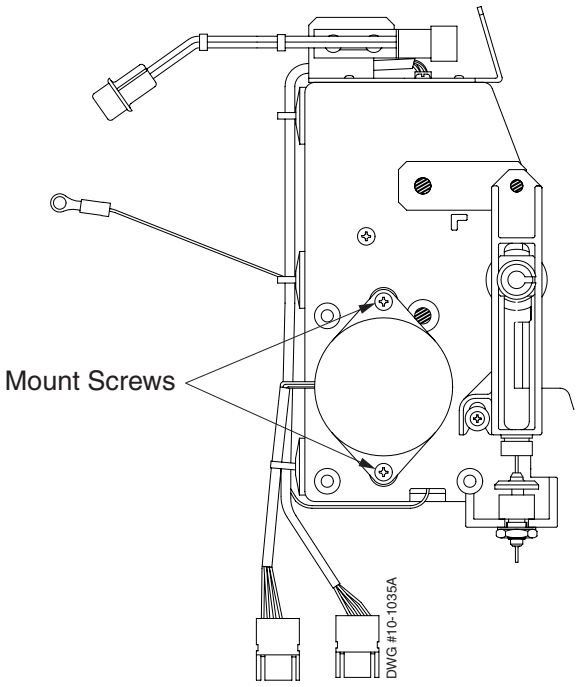


Figure 3-9 Removal of Motor Assembly

2. Remove the 2 mounting screws from the home detector.
3. Install the new detector by reversing these steps. Use new tie wraps as required to prevent fouling of the wires.
4. After restoring power, ensure the capillary adapter seals against the Fluid fountain in the Home position. If not, adjust the Home flag on the top gear.

NOTE: *Ensure the home flag enters the detector without obstruction.*

C. Gear Set (PN 22634)

1. The gears are held in position by compression springs. These can be removed by spreading the open end and lifting.
2. Remove the old gears noting the position and orientation of each gear. The noise damper is behind the middle gear.
3. After installing the new gears, ensure that the gears run freely.

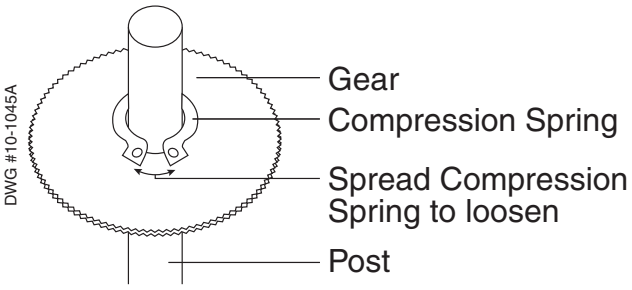


Figure 3-10 Removal of the Compression Spring

D. Fluid Fountain Assembly (PN 24620)

1. Rotate the gears so the capillary adapter lifts off the fluid fountain assembly.
2. Remove the S-Line from the bottom of the spike assembly.
3. Loosen the mounting nut (under the sampler bracket).
4. Slide the fluid fountain assembly off the sampler.
5. Move the washer and mount nut to the new assembly.
6. Slide the new assembly onto the sampler.
7. Rotate the sampler gears until the capillary presses down on the fluid fountain assembly.

NOTE: *The fluid fountain should be centered and should move downward between 0.06 to 0.08 inches (1.5 to 2.0 cm).*

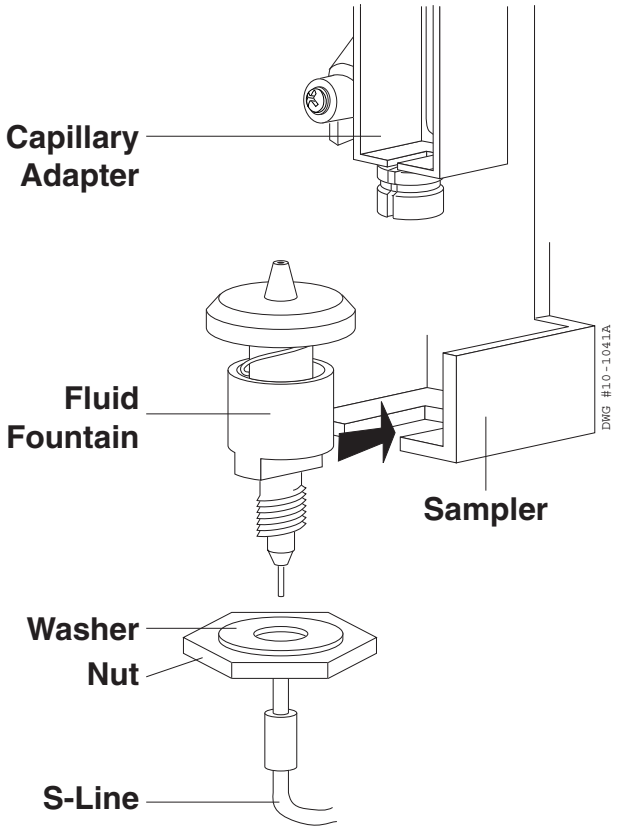


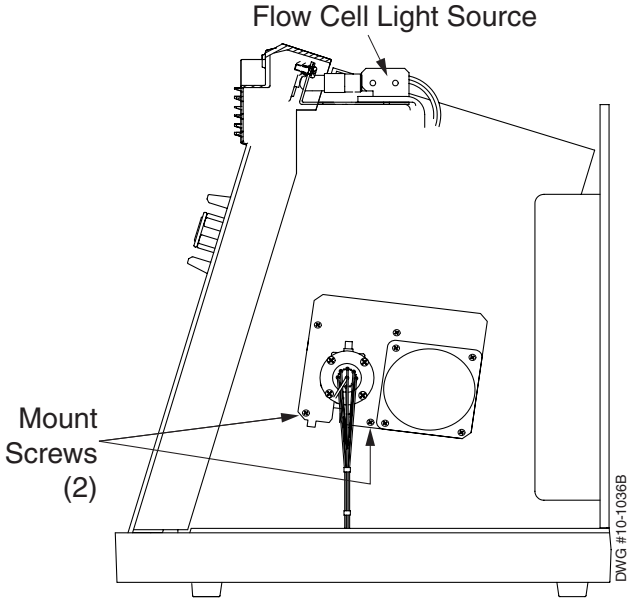
Figure 3-11 Fluid Fountain Assembly

3.5 Rotary Valve Assembly

The Rotary Valve Assembly (PN 23898) is removed as follows.

1. Remove the cover per Section 3.1.
2. Optional: Perform this step to enhance accessibility. Remove the sampler assembly per Section 3.4.
3. Remove the 7 tubes and S-Line from the rotary valve.

CAUTION: *Care should be taken not to scratch the metal tubes of the valve.*



4. Disconnect the motor connector J2 and the optical detector connector J9.
5. Loosen the 2 mounting screws at the bottom of the assembly.
6. Slide the assembly toward the front and lift.

NOTE: *The front of the valve bracket is hook shaped.*

7. Slide the assembly toward the back of the unit to clear the sampler bracket.

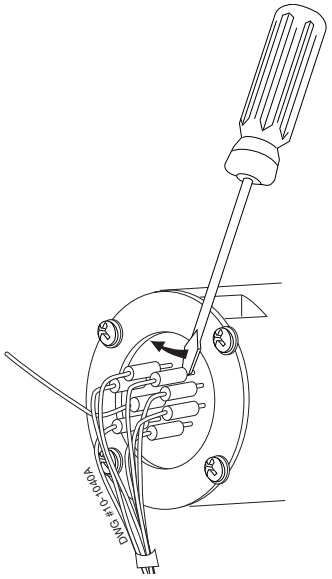


Figure 3-12 Removing Rotary Valve Assembly

8. If replacing the entire assembly, install the new rotary valve assembly by following Steps 1 thru 7 in reverse order.

NOTE: *Ensure the red, nonmetallic washers for the sampler mount screws stay in place during the remounting process. If only repairing the rotary valve assembly, refer to Section 3.6. If repairing the rotary valve motor, refer to Section 3.7.*

3.6 Valve Assembly

The Valve Assembly (Valve Repair Kit PN 24626) is removed as follows:

NOTE: The rotary valve assembly must be removed first before proceeding. (If not already removed, see Section 3.5.)

1. Remove “C” clamp on the valve shaft and remove the drive gear.

CAUTION: *Do not lose the shaft pin when removing the drive gear.*

2. With the drive gear removed, access and remove the 2 optical-detector mount screws.
3. Remove the optical detector.
4. Remove the 4 screws from the compression spring washer.
5. Remove the washer and compression spring.
6. Slide the rotor and tube manifold out of the valve body.

NOTE: *Before proceeding, note the alignment pin in the valve body that aligns with the slot in the manifold.*

NOTE: *Before installing the new parts, lubricate with a small drop of sealing oil on the mating surfaces.*

7. Slide the new rotor into the valve body. The large flange side goes in first. Align with the drive pins.

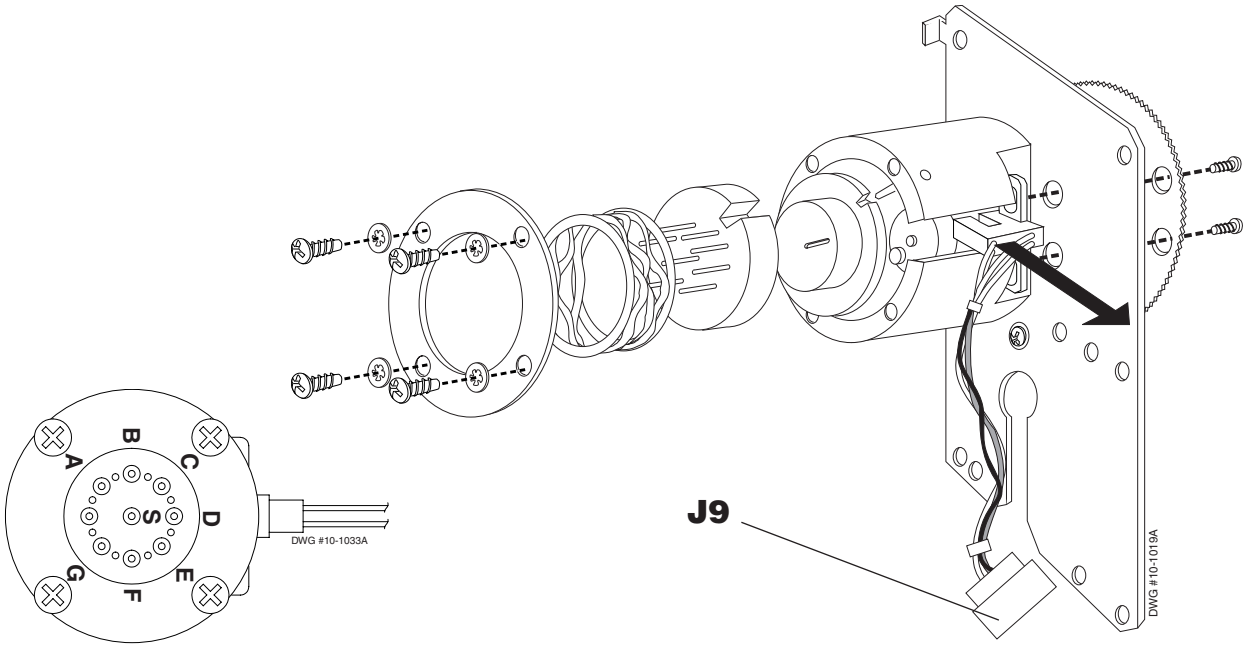


Figure 3-13 Valve Assembly Removal

8. Align the manifold with the pin and slide it into place.
9. Reinstall the compression spring and washer

NOTE: *Ensure the drive gear goes all the way over the shaft pin.*

10. Install the “C” clamp on the drive gear shaft.
11. Install the valve by reversing Steps 1 - 10 above.
12. Install the rotary valve assembly. See Section 3.5 and reverse Steps 1 thru 7.

3.7 Rotary Valve Motor

WARNING*: Unplug the power from the analyzer.*

The Rotary Valve Motor (PN 24627) is removed as follows:

NOTE: *The rotary valve assembly must be removed first before proceeding. (If not already removed, see Section 3.5.)*

1. Remove the drive gear/opto detector as in Steps 1 and 2 in Section 3.6.
2. Remove the 4 mounting screws from the motor.
3. Remove the fly wheel from the motor shaft by loosening the Allen (hex) screw.
4. Mount the new motor and opto detector.
5. Reinstall the rotary valve assembly. See Section 3.5 and reverse Steps 1 thru 7.

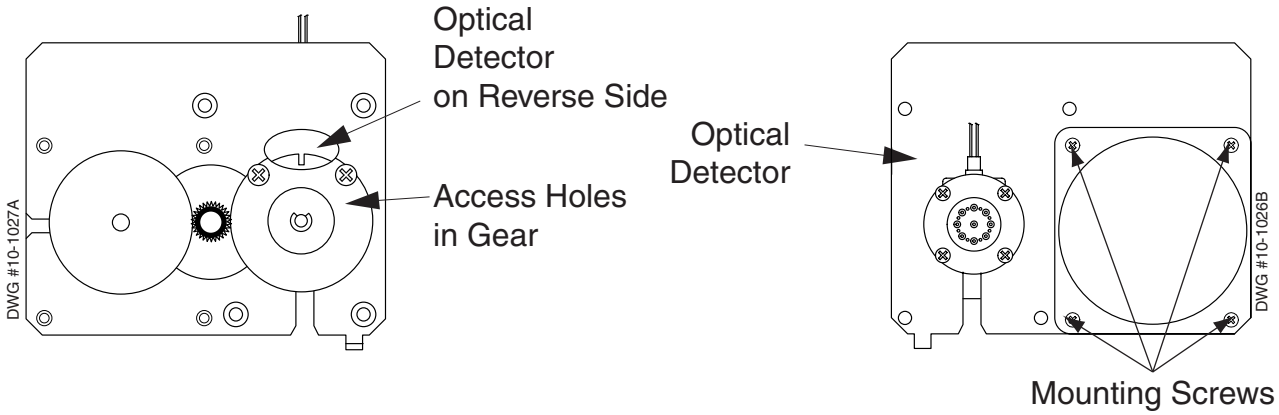


Figure 3-14 Optical Detector

3.8 Pump Assembly

The Pump Assembly (PN 23897) is removed as follows:

1. Remove the analyzer cover per Section 3.1.
2. Remove the digital control board shield. There are 4 mounting screws:
   One at the top front
   One at the bottom front
   Two at the bottom rear (above and below the PCMCIA card)

NOTE: *Take care not to lose the spacers on the screws.*

3. Remove the digital control board and mount plate.
   a. Disconnect the electric connectors (J7, J8, J9, and J10) from the top of the board.
   b. Disconnect J11 connector at the bottom front of the board.
   c. The digital control board and mount plate come off as one assembly. There are 4 mounting plate screws: two on the rear panel and two under the printer box.

NOTE: *Take care not to damage the board.*

   d. Slightly lift the mount plate and the board upward and out the side of the analyzer.

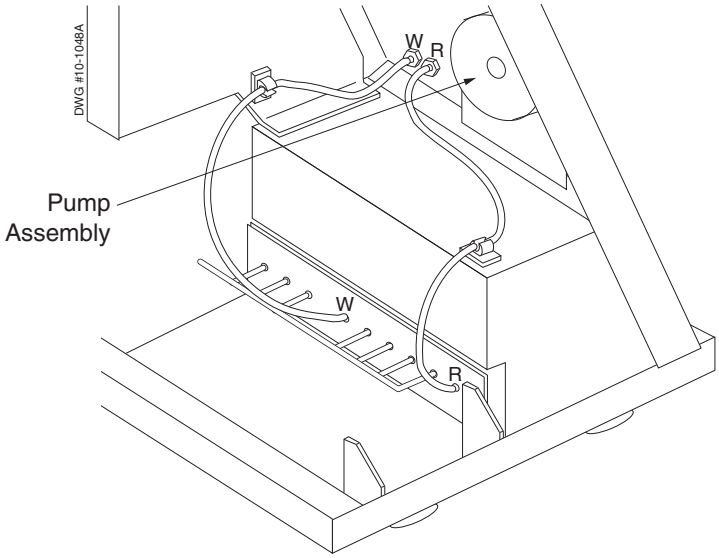


Figure 3-15 Pump Assembly

4. Disconnect the motor connector J1.
5. Remove the pump cap (on the front side of the pHOx) by pulling it off.
6. Remove the 4 corner mounting screws then remove the pump.
7. Install the new pump by reversing the above steps.

3.9 Digital Control Board

***WARNING**: Unplug the power from the analyzer.*

The Digital Control Board is removed as follows:

NOTE: *Units manufactured after June 1, 2005, use PN 40797; Units manufactured through June 1, 2005, use PN 24292.*

1. Remove the analyzer cover per Section 3.1.
2. Remove the digital control board shield. There are 4 mounting screws:
   -One at the top front,
   -One at the bottom front
   -Two at the bottom rear (above and below the PCMCIA card)

NOTE: *The shield is not present on units manufactured after June 1, 2005.*

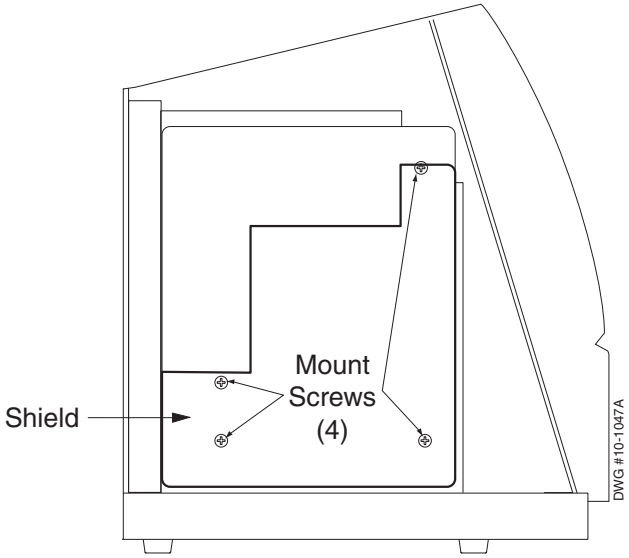


Figure 3-16 Digital Board Removal

NOTE: *Take care not to lose the spacers on the screws.*

3. At the top of the board, disconnect the electrical connectors:
   • J 7 - Power Supply
   • J 8 - Mechanical devices harness
   • J 9 - Printer (Pull side tabs outward to release the cable.)
   • J10 - Analog Board
4. At the front lower corner disconnect J11 – Display/ keyboard (pull side tabs outward to release cable).

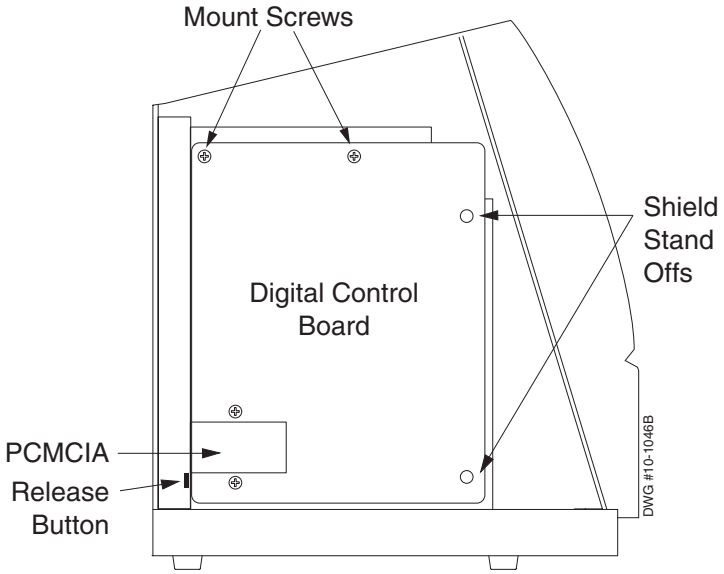


Figure 3-17 Install PCPMIC Card

5. Remove the PCMCIA card (PN 22805) Push the button below the PCMCIA card (bottom rear corner) to release the card.
6. Remove the 2 mounting screws and 2 shield standoffs:
   One screw is at the top rear corner
   One screw is between J8 and J9 connectors
   One shield standoff is at the top front and the other is at the bottom front
7. Remove the 8 COM connectors screw standoffs at the rear of the pHOx by unscrewing 2 standoffs from each COM port.
8. Remove the board.
9. Position the new board on the mount plate.
10. Install the 2 mounting screws and the 2 shield standoffs.
11. Install the 8 COM connector screw standoffs.
12. Reinstall the PCMCIA card into its slot.
13. Reconnect all the cable connectors.
14. Reinstall the digital board shield (4 screws).
15. Reinstall the cover and restore the analyzer to operation.

3.10 Analog Board

The Analog Board is removed as follows:

NOTE: *Basic/BiopHOx, pHOx/pHOx use PN 24291; pHOx Plus, Plus L,Plus C use PN 33390; all jumpers will be in the 3 to 4 position. To access the top/rear mounting screw, use a long shank (15 cm or 6 inch) Phillips® head (cross head) screwdriver.*

1. Remove the analyzer cover per Section 3.1.
2. Disconnect the sampler ground strap.
3. Disconnect the cable connectors from the Analog board Sensor Interface board connectors:
   J6 - 3 sensor board
   J7 - 2 sensor board
   J4 - Sensor module/SO_2 cable
   J3 - RMS/Fluid Deck (Pull side tabs outward to release cable.)
   J1 - Digital control board

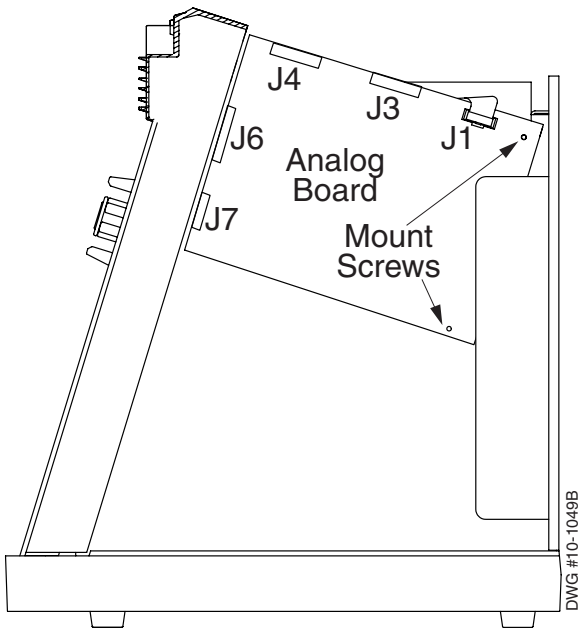


Figure 3-18 Analog Board Removal

4. Remove the 3 mounting screws: one in each corner of the board. You may need to place a screw driver through the holes in the power supply to access the screw in the upper back corner of the board.
5. Install the analog board by reversing the above steps.

3.11 Printer Assembly

***WARNING**: Unplug the power from the analyzer.*

The Printer Assembly (PN 24615) is removed as follows:

1. Remove the analyzer cover per Section 3.1.
2. Remove the digital control board per Section 3.7.
3. Open the front door; remove the 2 screws on top of the printer cover plate; remove the printer cover plate by pushing the plate from the inside outward; then remove the paper and roller bar.
4. Remove the 3 print head mounting screws: two at the top of the print head and one at the lower right.
5. The flat ribbon cable from the print head sits in a connector. Slide the top of the connector upward to release the cable. The connector stays on the board. Tilt the print head from the assembly. Remove the paper advance motor cable that is connected into the printer control board.

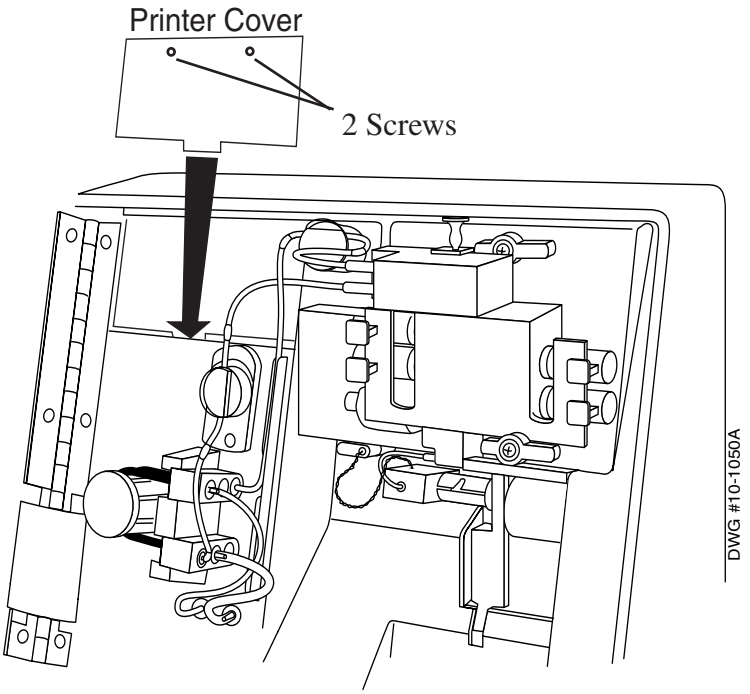


Figure 3-19 Printer Cover Removal

6. The Printer Control Board (PN 24614) is mounted to the paper box by 2 screws that fit into the slots. Loosen the screws and slide out the board.

NOTE: *Save cable that goes from the printer control board to J9 of the digital control board.*

7. When installing the new assembly, install the printer control board first. Do not tighten the 2 slotted screws. This allows access when connecting the print head cable. Attach the paper advance motor cable to the printer control board.
8. Install the print head. Connect the flat ribbon cable. The easiest way to plug in the print head cable is using one finger on each side. Tighten the 3 print head screws.

NOTE: *The print head cable is clamped in place. Lift up on the white connector to release the flat cable for easy removal or replacement.*

9. After connecting the print head, tighten the printer control board mounting screws inside the paper box.
10. Attach the cable from the printer control board (key faces up, blue or black wire faces towards the front of unit) to the digital control board.
11. Reinstall the digital control board, shield, printer cover, analyzer cover, and paper. Restore unit to operation.

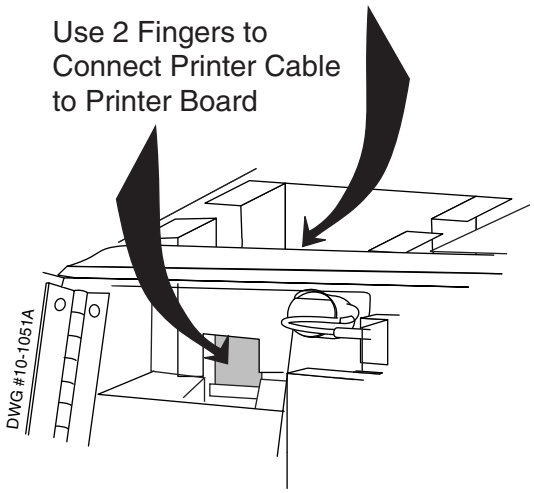


Figure 3-20 Attaching the Printer Cable

3.12 Sensor Module Light Source

The Sensor Module Light Source (PN 24717) is removed as follows:

1. Remove the analyzer cover per Section 3.1.
2. Remove the 2 screws of the light source mounting bracket.
3. The light bulb is removed by pushing it into the socket, rotating it counterclockwise a 1/4 turn, then releasing it.

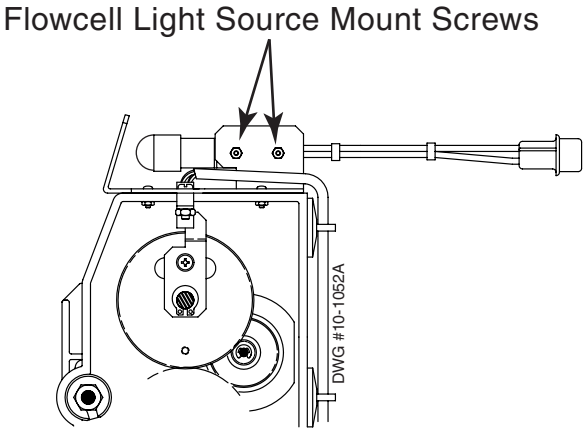


Figure 3-21 Removing Mounting Screws

CAUTION: *Do not touch the glass surface of the new light.*

4. Place the glass end of the new light bulb into the tubing provided.
5. Insert the light bulb into the socket. Push it in and rotate it clockwise a 1/4 turn. Then pull off the tubing.
6. Reinstall the bracket.
7. Reinstall the covers and restore the unit to operation.

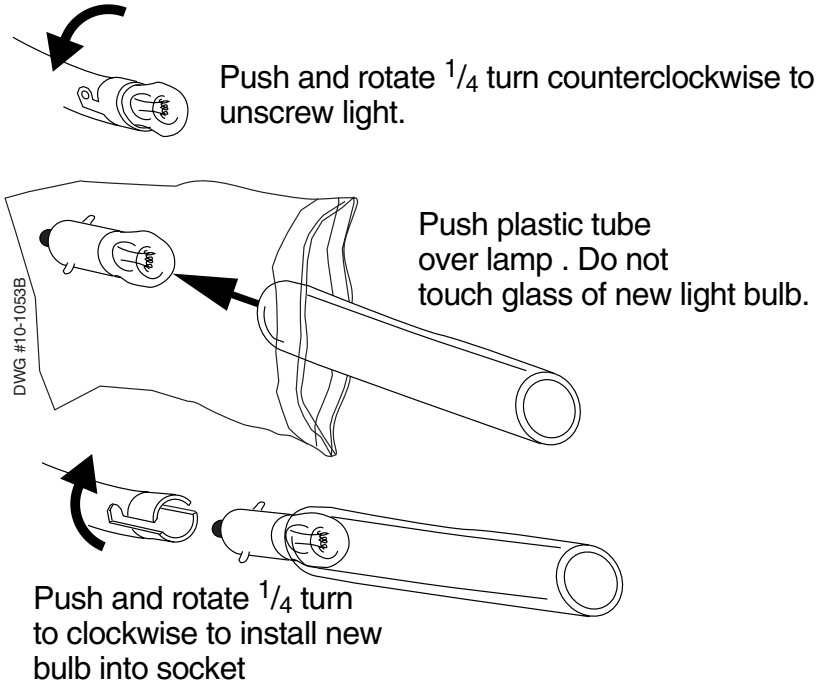


Figure 3-22 Tubing for Light

3.13 Door Removal /Reinstallation Procedure

1. Turn the unit OFF and disconnect the line cord.

STOP: *Use a pencil to trace the position of the hinge onto the door mounting plate.*

CAUTION: *Until free of the hinge and cables, support the door to prevent stress to other cables/ assemblies.*

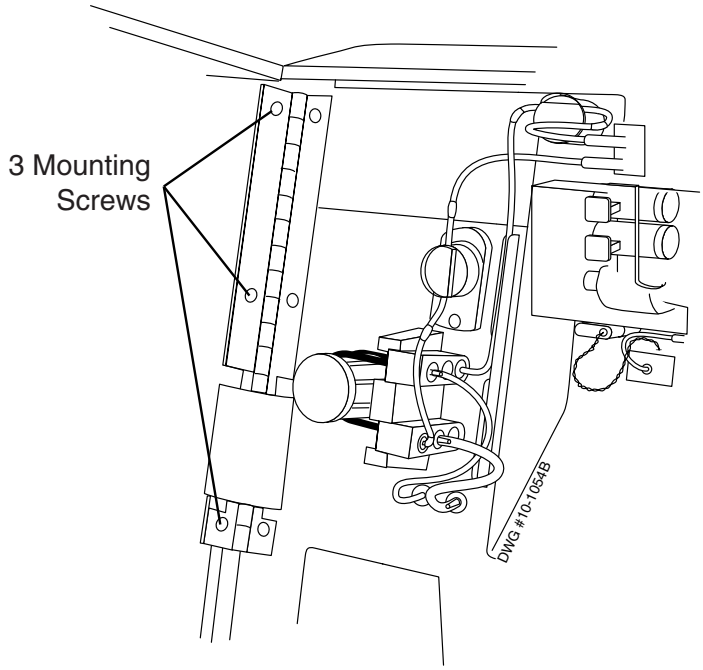


Figure 3-23 Door Removal

2. Remove the 3 hinge screws from the door plate.
3. Remove the 5 plate-mounting screws: one in each corner, plus one at right side.

NOTE: *Care should be taken not to strip the threads.*

4. Remove the plate and disconnect the flat cable (J101). This frees the door. Place it face down on a protective surface to prevent scratching.

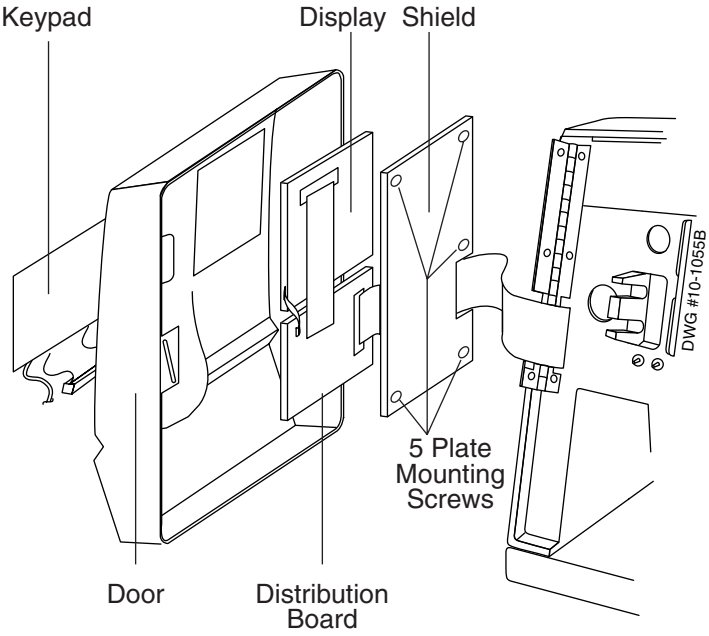


Figure 3-24 Door Removal Continued

5. Reinstall the Door by reversing the above steps. Use the pencil marks made on the door plate to realign the door to the hinge. Ensure the door opens and closes easily and aligns with the chassis.

Analyzer	PN of Door
pHOx	21493
pHOx Basic/ BiopHOx	33102
pHOx Plus	30817
pHOx Plus L	34082
pHOx Plus C	35350

3.14 Display Assembly

The Display Assembly is removed as follows:

	Prior to June 1, 2005	June 1, 2005 forward
Display Assy.	24716	40910
Door Distribution Board	24727	40795
Digital Control Board	24292	40797
Door Interface Cable	21983	40495

1. Remove the analyzer door assembly per Section 3.13.
2. Disconnect the cable from the display board (CN2).
3. Disconnect the light source, J103, on the distribution board.
4. Remove the 4 corner mounting screws.

CAUTION: *When reinstalling the mount screws, DO NOT overtighten. Assure the door plastic is not stripped. The screws will tighten in about one turn clockwise.*

5. Position the new display and install the 4 mounting screws. Reconnect the cables CN2 and J103.
6. Reinstall the door per Section 3.13.

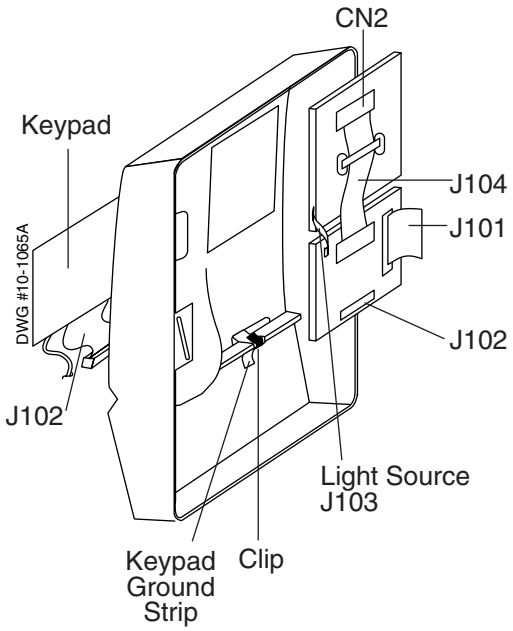


Figure 3-25 Display Removal

3.15 Distribution board

The Distribution Board (PN 24727) is removed as follows:

1. Remove the analyzer door per section 3.13.
2. Disconnect the cable connectors J104 and J103 coming from the display board, J101 coming from the digital control board (should already be disconnected), and J102 coming from the Keypad. (Refer to Figure 3-25.)
3. Remove the 4 corner mounting screws.
4. Position the new distribution board (J101 will be on the hinge side of the door) and remount.

CAUTION: *When reinstalling the mount screws, DO NOT overtighten. Assure the door plastic is not stripped. The screws will tighten in about one turn clockwise.*

5. Reconnect cables J104, J103, J102, and J101.
6. Reinstall the door per Section 3.13.

3.16 Keypad Assembly

The Keypad Assembly (PN 24625) is removed as follows:

1. Remove the analyzer door per Section 3.13.
2. Disconnect the cable connector J102 from the distribution board.
3. Remove the clip holding the keypad ground strip to the door. Save this for reuse.
4. The Keypad is held by adhesive to the front panel. Peel the old assembly from the front of the door.
5. Clean the surface of any debris.
6. Remove the protective backing from the new keypad.
7. Slide the cable/ground strap through the hole in the door. Align and press new keypad in place.
8. Fold the ground strap over the ledge and reinstall the clip.
9. Plug in J102 and reinstall the door per Section 3.13.

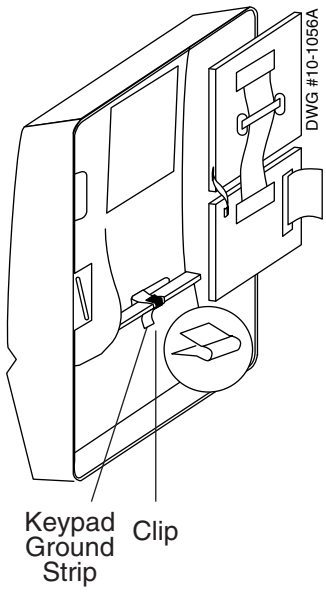


Figure 3-26 Keypad Removal

3.17 Sensor Module Assembly

***WARNING**: Unplug the power from the analyzer.*

The Sensor Module Assembly is removed as follows:

1. Remove the sensors (electrodes) and sample probe/ADT1 assemblies.
2. Remove the reference electrode assembly.
3. Rotate the retaining clamp on the top and the bottom of the assembly.
4. Pull the assembly toward you.
5. Remount by reversing these steps.

NOTE: *The preheater and SO_2 component are all part of this assembly.*

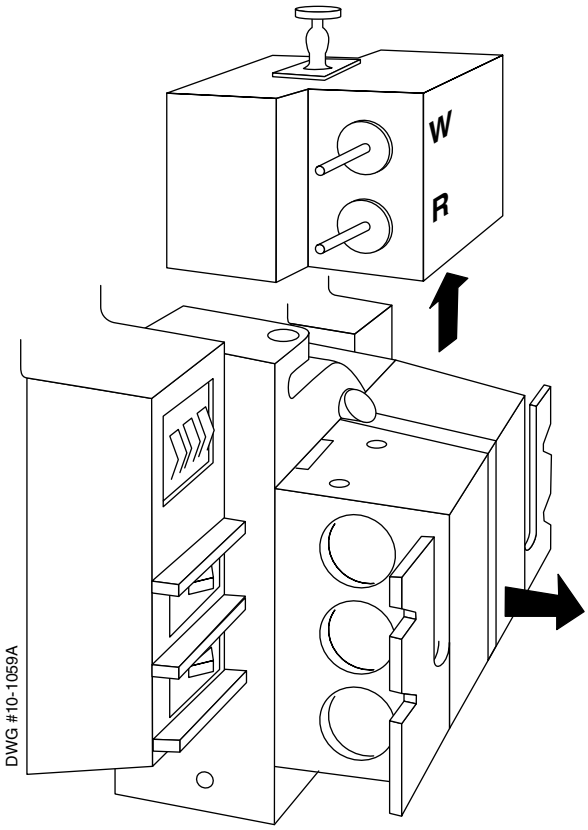


Figure 3-27 Removing the Sensor Module

Sensor Module Part Numbers

Analyzer	Part Number
pHOx	21494
pHOx Basic/BiopHOx	34653
pHOx Plus	27807
pHOx Plus L	34738
pHOx Plus C	37343

3.18 Electrode Interface Boards

This section pertains to the pHOx, pHOx Basic, and BiopHOx Analyzers only.

***WARNING**: Unplug the power from the analyzer.*

The Electrode Interface Boards (PN 24719 {left} and PN 24718 {right}) are removed as follows:

1. Remove the analyzer's cover per Section 3.13.
2. Remove the sampler assembly per Section 3.4.
3. Remove the sensor module assembly per Section 3.17.
4. Remove the spring loaded sensor module retaining clips (front of pHOx).
5. Remove the 3 remaining mount screws.

NOTE: *The top left corner screw was removed with sampler removal.*

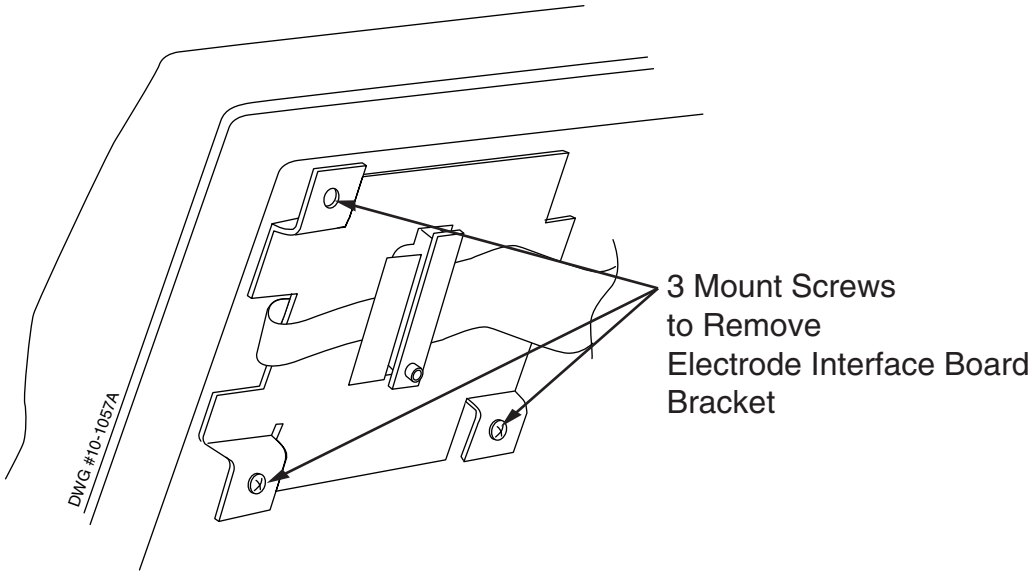


Figure 3-28 Removing the 3 Mount Screws

6. Pull the electrode interface board out thru the inside of the pHOx.

7. Each interface board is held to the plate by 2 screws. Ensure that the 3 connector board is on left, and the 2 connector board is on the right when looking at it from the front.

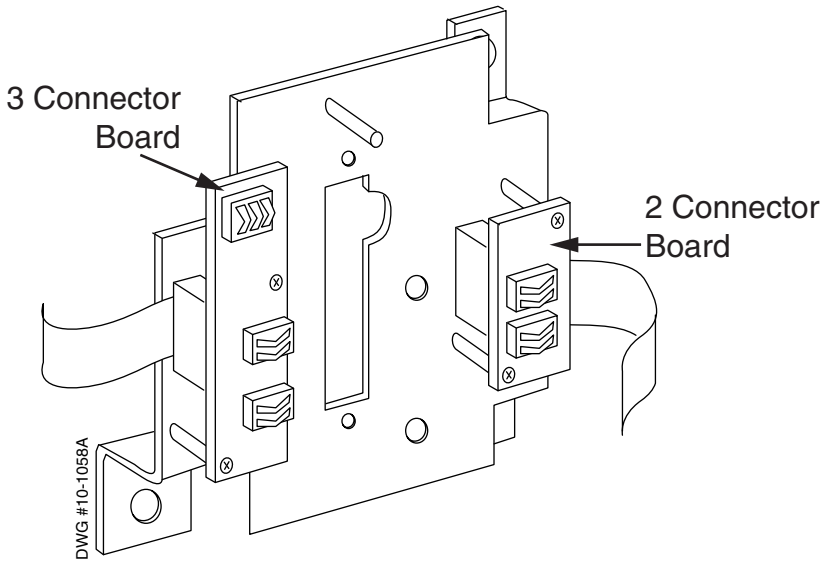


Figure 3-29 Correct position of Interface Board

8. Disconnect the affected board from the analog board: 3 connector board to J6, 2 connector board to J7.
9. Install new assembly by reversing the above steps.

3.19 Pinch Valve Assemblies

The Pinch Valve Assemblies (PN 16928) are interchangeable. The assembly plugs into the front panel and is held in by one screw.

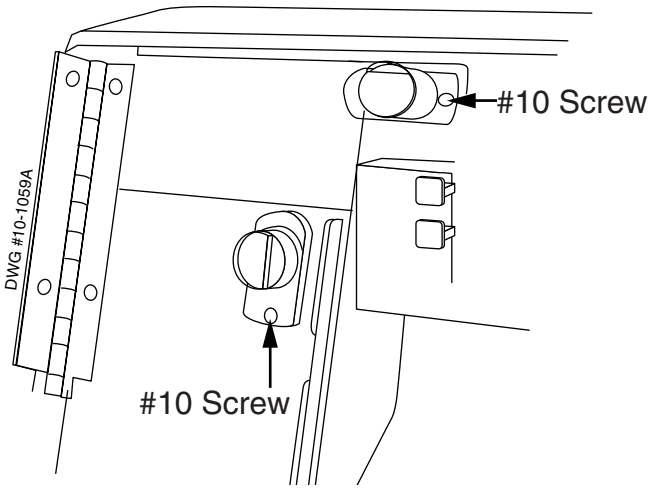


Figure 3-30 Pinch Valve Assemblies

4.0 Troubleshooting Information

This section contains suggestions for individual error codes, cycle information to help identify the cause of an error condition, and hints on basic troubleshooting.

1. Troubleshooting is recognizing the variance from normal operation. The calibration cycle can be used as the sequence of events where the cycle response and results are known.

	Fluid Function
Start cycle	
Std. A	all 4 ADTs, Hct, PCO_2, Na^+, K^+, iCa, Cl^-, Gluc, Lact
Std. B	PCO_2
Std. C	pH, Na^+, K^+, Cl^-, Gluc, Lact, (iCa on pHOx +L)
Std. D	all ADTs, pH, Hct, (iCa on pHOx+C)

PO_2 uses Room Air (A-air position of the rotary valve).
SO_2/Hb utilizes external calibrators. (These are model specific.)

2. Sensor Methodology

ISE sensors - Na^+, K^+, iCa, Cl^-, pH, and PCO_2
ISE requiring a reference signal - Na^+, K^+, iCa, Cl^-, pH
ISE with its own internal reference - PCO_2
Reflected Impedance - Air Detectors 1,2,4, 3/Hct
Amperometric - PO_2, Glucose, Lactate
Optical Reflectance - SO_2%

3. Calibrator Functions other than calibration.

PO_2 Std. B is used to flush the system.
PO_2 is monitored on all fluids in the Calibrator pack. If the PO_2 millivolt reading varies from that of room air, a 72 Delta mV error is generated indicating a contaminated calibrator pack.
Std. D has surfactant and is used to clean the flowpath between pump cycles.

4. Dependencies (Refer to the quick reference guide in the appendix.)

   Hct Calibrated Na^+ required

NOTE: *The pHOx Na^+ is a 30 day expendable electrode.*

SO_2%	Calibrated Hct and PO_2 required
Hb	Calibrated Hct and SO_2% required
PCO_2	Calibrated pH required

Calculated values will not be reported if a needed test is suppressed.
P50 is reported only if PO_2 is between 30 mmHg (4 kPa) and 75 mmHg (10 kPa).

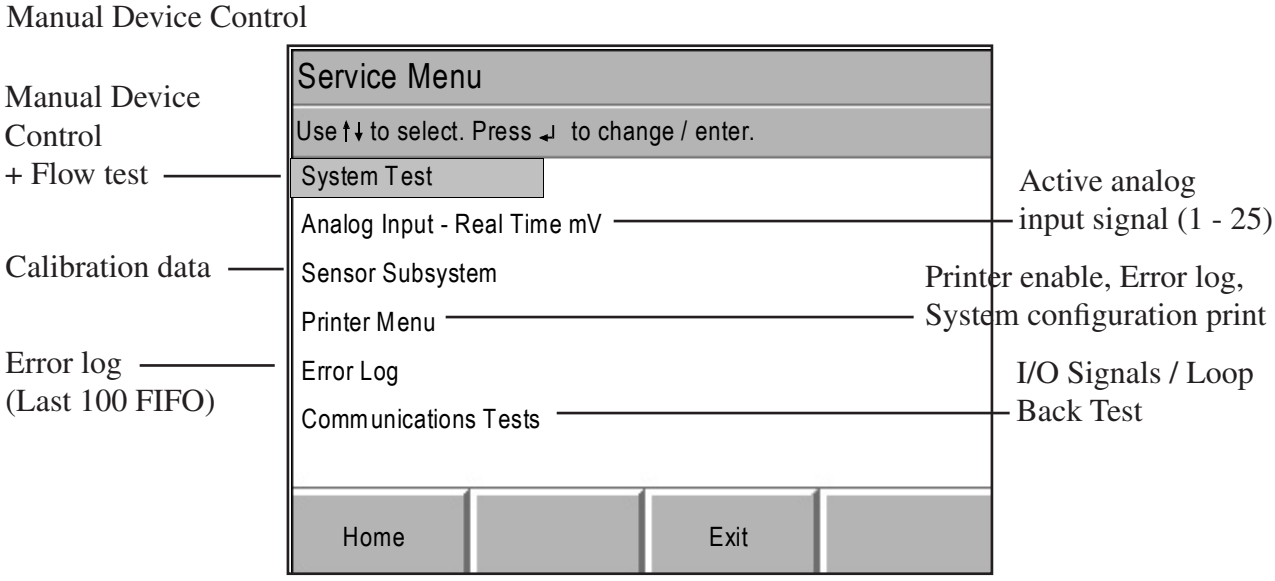
5. Password protection - One password for Set Up, QC, and Service menus. Should the password be lost, enter the following number when asked for the password.
   Date Code
   "Back-door" Password = (((month x 31) + day) x 137) + (year x 16)) + 5987
   2 digits 2 digits last two digits

   Example: If today is 02 January 2003 the "back-door" password would be:
   Password = (((01 x 31) + 02) x 137) + (03 x 16)) + 5987
   = (33 x 137) + 48 + 5987
   = 4521 + 48 + 5987 = **10556**

   Change the password to a known value and write it down.

4.1 Service Screens

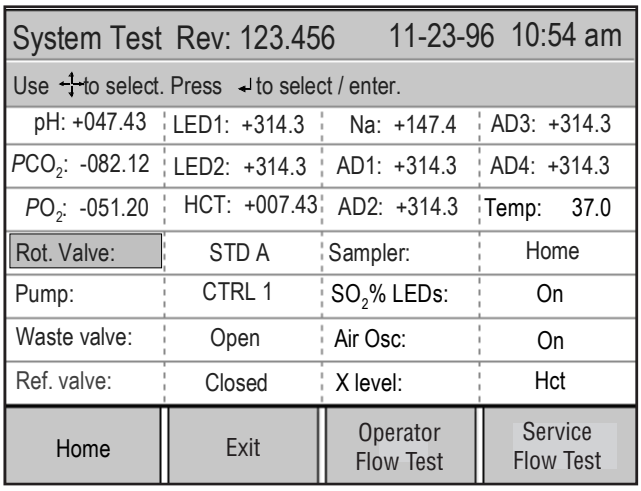
Pressing the “MENU” soft key from the “Ready Screen” displays an “Operation Menu.” Note that the soft key labels change. The “QC” label changes to “Service” (second key from the left). Pressing this key will display the Service Menu. If the home key is pressed, the system returns to the “Ready Screen.”



4.1.1 System Test Screen

Measured Parameters/
Current signal (millivolt)

Device Names (column 1&3) /
Current state of the device (column 2&4)



Manual Control of a mechanical device:

- Move the cursor over the device /Press “ENTER.”
- The Option selections will appear.
  (If there are only 2 options, the device will toggle its state when the “ENTER” key is pressed, i.e., solenoid valves.)
- Move the cursor over the option wanted /Press “ENTER.”

NOTE: *To successfully move fluids, a knowledge of the complete flow path is required.*

4.1.1.1 Operator Flow Test

Pressing the soft key under the Operator Flow Test turns on the pump and raises the sample probe. Use the guide in this Section titled Flow Problems in Conjunction with the Operator Flow Test.

4.1.1.2 Service Flow test

Pressing the soft key under the Service Flow Test brings up a screen that displays the results of this test. On this screen, pressing the soft key under Run Test causes the unit to pump each fluid twice: once with the Reference valve shut and once with the Reference valve Open.

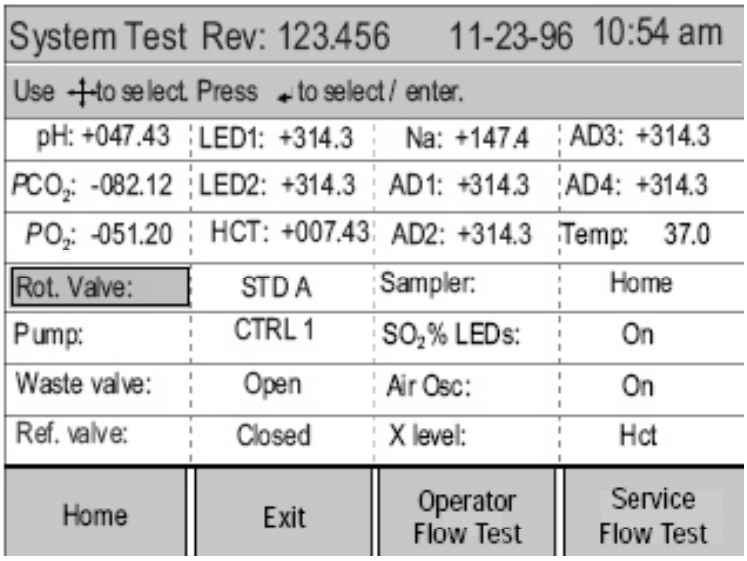
The expectation is that the flow time will increase with the decrease in vacuum caused by pumping reference solution into the waste line junction in the reference electrode. Ideally the 2 pump windings are equal and the flow time will double with the reference solenoid valve open.

The pumping times will yield 2 pieces of information:

1. The individual flow times appear at the end of pumping that fluid.
2. All the fluids will pump at the same rate. Usually Standard D is the one standard that varies in flow rate from the other fluids.

A good rule of thumb for the flow rates is

pHOx Basic/BiopHOx and pHOx is in the 1000 – 1200 range.
pHOx Plus/C is in the 1200 – 1300 range.
pHOx Plus L pumps in the 1300 – 1400 range.



At the end of the Test, the Average flow time for Reference Valve Closed and Reference Valve Open is displayed. A ratio of the average times is presented. The ratio should fall between 0.5 – 0.65.

- Ratios approaching 1 indicate the loss of reference flow.
- Ratios approaching 0.0 indicate an obstruction or air leak in the system before the flowpath reaches the Reference electrode.

FLOW TEST RESULTS			
CAL A	1190	AVG FLOW 1	
CAL B	1195	AVG FLOW 2	
CAL C	1190		
CAL D	1170	RATIO	
QC 1	1195		
QC 2	1193		
QC 3	1195		
Home	Print	EXIT	Run Test

Average Flow time Reference Valve Shut

Average Flow time Reference Valve Open

Flow 1/Flow 2 (nominal 0.5 – 0.65)

4.1.2 Analog Input Screen

Selecting this option, displays the 25 possible input channels. The display is active.

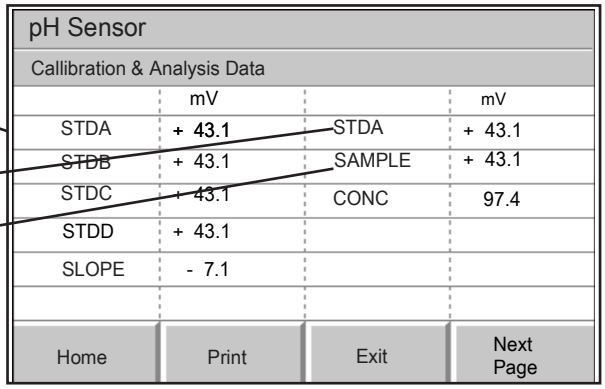
Chnl	Signal	Unit	Chnl	Signal	Unit
1	Analog GND	ALL	15	PO_2	pHOx+, pHOx+ C
2	K^+	pHOx+,+L,+C	15	Lac	pHOx+L
3	Cl^-/Ca^{++}	pHOx+,+L	16	Glu	pHOx+,+L,+C
3	Cl^-	pHOx+C	17	PO_2	pHOx+L
4	Ca^{++}	pHOx+C	18	PO_2	pHOx+,+C
5	pH	pHOx	18	Lac	pHOX+ L
5	Na^+	pHOx+,+L,+C	20	Temp 0.00=37C	
6	Na^+	pHOx	22	LED1	ALL
6	pH	pHOx+,+L,+C	23	LED2	ALL
7	PCO_2	All	24	ISE Ref	ALL
8	Barr.Press.	All	25	PCO_2,Ref	ALL
9	+5V Ref	All			
13	HCT	pHOx, pHOx+C	14	PO_2	pHOx, pHOx+C
10	Voltage Monitor Sums +24 and +5				

4.1.3 Sensor Subsystem

This set of screens shows the calibration data for each analyte measured by the pHOx. Use the "NEXT" soft key to page to the analyte of interest.

Last 2-point calibration data
Millivolts for each standard
Slope calculated

Last 1 point data
(Millivolts should be similar
to the same Standard in 2 point cal)

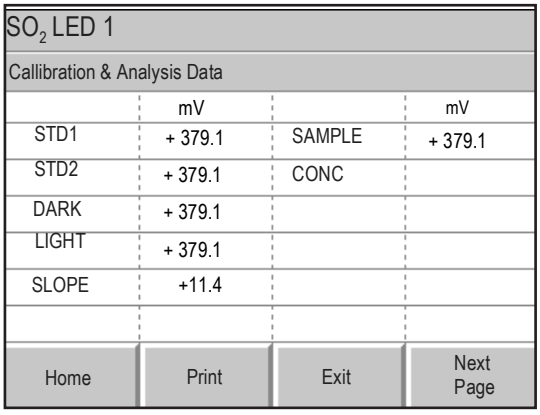


Sample millivolts and concentration - Unknown and therefore not relevant to troubleshooting

Useful to the clinician for any possible dilution

SO_2 sensors - Each LED has its own screen.
Displays similar data to the other
Measured parameters, plus

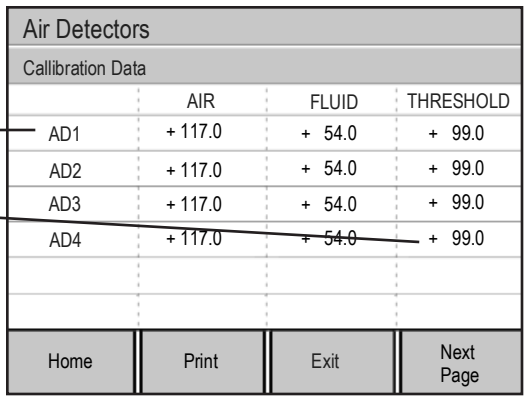
The "dark" (off) and "Light" (full)
Signals are shown



Air Detector Subsystems

Displays the millivolts for Air and
Liquid. (Air column is actually Standard D.)

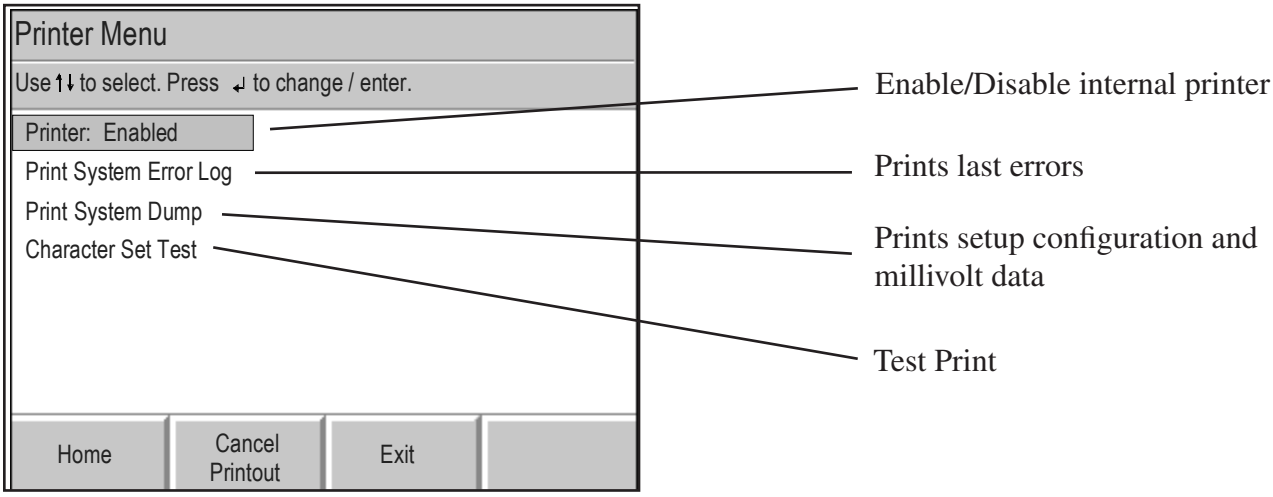
Shows the AIR/Liquid threshold
(set by the analyzer) millivolt level



NOTE: *Numbers shown on this screen* are not real values.

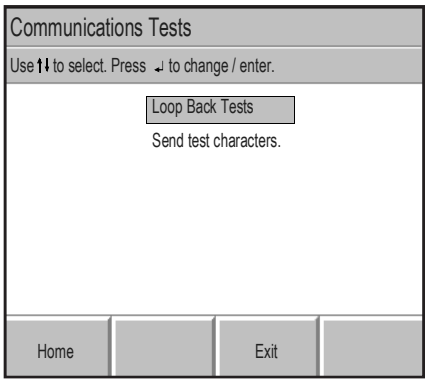
4.1.4 Printer Menu

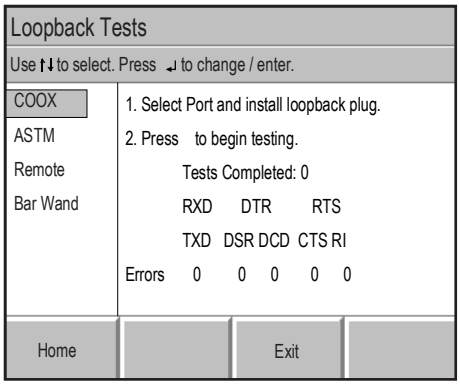
This menu is straight forward. Move the cursor to the desired action and press “ENTER”

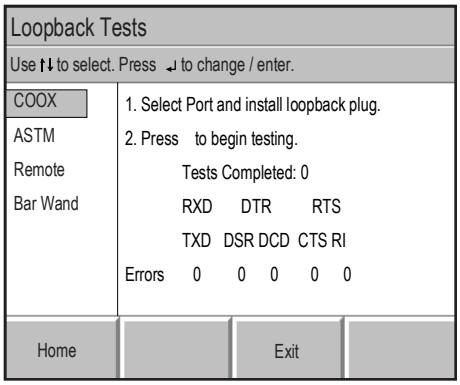


4.1.5 Communication Tests

This screen allows you to transmit out a particular port for testing. Likewise using a test plug you can perform a Loopback test for each I/O function.







Pressing the “HOME” key returns to the READY screen, or EXIT to go back one screen.

4.2 Flow Problems

NOTE: *Each of the following troubleshooting procedures has an associated flow diagram that may be found at the end of this chapter.*

General procedures when isolating flow problems:

NOTE: *Refer to the FLOW TEST decision tree. Do not be confused with the Flow Test Cycle that only shows the flow times.*

Unit calibrates, but the sample will not aspirate. This usually means you have an air leak into the system. The sample, being more viscous than the aqueous standards, causes more vacuum to be created by the roller pump. If a membrane is leaking, this increase in vacuum will pull the aqueous fill solution from the electrode, easier than pulling sample from the probe. Likewise, a poor connection at the interconnect tubing or between the electrode sealing washer and the sensor module will allow air to enter easier than pulling sample up the flow path.

- Check the connections between probe and sensor module, sensor module, and reference electrode.
- Check the electrodes for the loss of internal fill solution.
- Check the flow cell window during a pump cycle, looking for bubbles entering the flow path or pump and waste tubing.

A No flow or obstructed flow cause can be isolated by performing the FLOW TEST. The fluidic system can be isolated into three large sections. This will limit the area of your search. The 3 sections are Fluid Pack to Fluid Fountain, Sampler/Sensor module, and W/R to Waste tubing. Use the SYSTEM TEST screens to control the mechanical devices.

1. Extend the sampler to the syringe position.
2. Open the waste line solenoid.
3. Turn on the pump and attempt to aspirate water then air from a sample cup.
4. If water is aspirated from the cup, the sample probe, sensor module, external tubing, and waste line are functioning. The problem exists between the Fluid Fountain and Fluid Pack.
5. If water is NOT aspirated from the cup, remove the tubing from the outlet port of the Reference electrode. Place it in a cup of water.

NOTE: *This assumes the waste solenoid has functioned and is not pinching the tubing.*

6. If step 5 fails to aspirate from the cup, the problem lies between the W/R tubing and the waste bottle of the Fluid Pack.
7. If Step 5 does aspirate water, the problem is in the Sampler/ Sensor module.

4.2.1 Isolating a Plug in the W/R to Waste Tubing

NOTE: *If the reference flow is obstructed, the sample may not stop in the sensor module due to increased vacuum. Flow time decreases due to increased flow rate.*

1. Disconnect the waste tubing from the reference electrode and place in a cup of water. If water is NOT aspirated, there is a plug.
2. Lift the waste tubing out of the waste solenoid. If flow starts, the valve is dirty. Clean the dirt from the waste solenoid or replace it.
3. If flow does NOT start, remove the waste line from the front panel connection. If water flows from this tube there is a plug in the internal waste tubing or waste bag of the fluid pack.
4. Turn off the pump. Connect a syringe of water to the waste port on the front panel. Attempt to inject water through the line to clear the plug.
5. If there is no flow, remove the Fluid Pack to ensure the problem is not a poorly seated or damaged waste connection. Should the problem continue, replace the internal tubing set.

4.2.2 Isolating a flow problem in the Sampler/Sensor module

1. You noted flow when aspirating from the waste tubing in step 2 of **Section 4.2.3**.
2. Raise the Sampler to the Syringe position. The Pump should be OFF for this test.
3. Connect a syringe of water to the reference electrode outlet port. Attempt to inject the water.
4. If water flows freely, air is entering the system preventing aspiration.
   a. Inspect each electrode to assure the internal fill solution level is not dropping.
   b. If yes, replace the electrode or membrane as required.
   c. Inspect the seal between the reference electrode and sensor module (interconnect tubing) .

NOTE: *If the flow path starts to empty while the syringe is still attached, only the water below the leak will leave the flow path out of the tip of the probe.*

d. Inspect the sensor sealing washers for distortion or misalignment. Replace as necessary.
e. The seal between the air detector and the sample probe may be tested by attaching the syringe to the sample probe, blocking the air detector outlet tube. Apply pressure to the syringe and look for water leaking out.

5. If water does not flow freely, there is a blockage.
   a. Loosen the reference electrode. Water should pass through or the electrode is plugged. Flushing with cleaning agent or hot water may free the blockage.
   b. If the reference is clear, reinstall it and remove the bottom electrode.
   c. Apply a moderate pressure with the syringe.
   d. If water does not enter the sensor module of the bottom electrode the blockage is above it.
   e. Removing one electrode at a time. Look for water entering the sensor module. If no water enters the module as the electrode is removed, the plug is above it.
   f. If water did enter the bottom sensor module in step C above, the plug is in the Sample Probe/Air detector. Remove these assemblies and flush through them or replace them.

4.2.3 Isolating a flow problem between the Fluid Pack and the Fluid Fountain

If you have successfully aspirated a sample, but the analyzer will not calibrate or aspirate on-board controls, proceed as follows.

1. Position the sampler in the syringe position and inspect the capillary adapter for signs of wear. Replace if necessary.
2. Lower the sampler to the Home position; connect a syringe to the reference outlet port.
3. Remove the analyzer cover.
4. Disconnect the S-Line (center tube) from the rotary valve.
5. Inject the water and look for flow from the S-Line.
6. Look for a leak between the fluid fountain and the capillary adapter. Realign if necessary.
7. **If there is no flow** from the S-Line, remove the fluid fountain/S-Line and flush with hot water or cleaning agent, or replace the assembly.
8. **If there is free flow** through the S-Line, the problem is in the rotary valve, tubing harness, or connection to the fluid pack.
9. Reconnect the S-Line and remove the fluid pack.
10. Move the rotary valve to all the possible positions, observing which ports do not allow flow.
11. **If there is no flow** in ALL positions, remove the valve and clean or replace it.

12. Remove the tubing for each position that does not flow freely.
13. **If water can be flushed** through the individual lines, remove and clean or replace the valve.
14. If water cannot be flushed through the affected lines, replace the tubing harness.

4.3 Status Codes

Error codes come in 2-digit groups. The tens (first) number, called the "series code," identifies the affected component.

Series 1 through 6 are sensors,

0 = pH 1 = PCO_2 2 = PO_2 3 = SO_2 % 4 = Hb 5 = Hct 6 = Na^+

Series 7 = flow, 8 = Q.C. 9 = Electronic/Mechanical/Hardware 10 = CO-Oximeter codes.

The ones (second) number, called the "digit code," provides more information on the failure.

Series -	1 - 6	7	8	9	10
Digit code					
-1	Slope	No Std.A	No QC1	Barometer	Not assigned
-2	Instability	No Std.B	No QC2	Printer	
-3	Overload	No Std.C	No QC3	Flow Cell Temp	
-4	Drift	No Std.D		Communication	
-5	Dependency			Digital Board	
-6		Sample flow		Analog Board (ADX)	
-7		Air flow		Software	

pH Status Codes

Code	Status Screen Text	Error Log Text
01	pH Slope	pH Slope
02	pH Instability	pH Instability
03	pH Overload	pH Overload
04	pH Drift	pH Drift
96	Hardware	pH ADC
97	Software	pH Math

PCO_2 Status Codes

Code	Status Screen Text	Error Log Text
11	*P*CO_2 Slope	*P*CO_2 Slope
12	*P*CO_2 Instability	*P*CO_2 Instability
13	*P*CO_2 Overload	*P*CO_2 Overload
14	*P*CO_2 Drift	*P*CO_2 Drift
15	*P*CO_2 Dependency	*P*CO_2 Dependency
96	Hardware	*P*CO_2 ADC
97	Software	*P*CO_2 Math

PO_2 Status Codes

Code	Status Screen Text	Error Log Text
21	*P*O_2 Slope	*P*O_2 Slope
22	*P*O_2 Instability	*P*O_2 Instability
23	*P*O_2 Overload	*P*O_2 Overload
24	*P*O_2 Drift	*P*O_2 Drift
96	Hardware	*P*O_2 ADC
97	Software	*P*O_2 Math

SO_2 LED 1 Status Codes

Code	Status Screen Text	Error Log Text
31	*S*O_2 % Slope	*S*O_2 % LED1
32	*S*O_2 % Instability	*S*O_2 % LED1
33	*S*O_2 % Overload	*S*O_2 % LED1
34	*S*O_2 % Drift	*S*O_2 % LED1
35	*S*O_2 % Dependency	*S*O_2 % Dependency
96	Hardware	*S*O_2 % LED1 ADC
97	Software	*S*O_2 % LED1 Math

SO_2 LED 2 Status Codes

Code	Status Screen Text	Error Log Text
31	*S*O_2 % Slope	*S*O_2 % LED2
32	*S*O_2 % Instability	*S*O_2 % LED2
33	*S*O_2 % Overload	*S*O_2 % LED2
34	*S*O_2 % Drift	*S*O_2 % LED2
96	Hardware	*S*O_2 % LED2 ADC
97	Software	*S*O_2 % LED2 Math

Hb Status Codes

Code	Status Screen Text	Error Log Text
41	Hb Slope	Hb Slope
45	Hb Dependency	Hb Dependency
97	Software	Hb Math

Hct Status Codes

Code	Status Screen Text	Error Log Text
51	Hct/Air Det Slope	Hct
52	Hct/Air Det Instability	Hct
53	Hct/Air Det Overload	Hct
54	Hct/Air Det Drift	Hct
55	Hct/Air Det Dependency	Hct
96	Hardware	Hct ADC
97	Software	Hct Math

Na^+ Status Codes

Code	Status Screen Text	Error Log Text
61	Na Slope	Na Slope
62	Na Instability	Na Instability
63	Na Overload	Na Overload
64	Na Drift	Na Drift
96	Hardware	Na ADC
97	Software	Na Math

AD1 Status Codes

Code	Status Screen Text	Error Log Text
51	Hct/Air Det Slope	AD1
52	Hct/Air Det Instability	AD1
53	Hct/Air Det Overload	AD1
96	Hardware	AD1 ADC
97	Software	AD1 Math

AD2 Status Codes

Code	Status Screen Text	Error Log Text
51	Hct/Air Det Slope	AD2
52	Hct/Air Det Instability	AD2
53	Hct/Air Det Overload	AD2
96	Hardware	AD2 ADC
97	Software	AD2 Math

AD3 Status Codes

Code	Status Screen Text	Error Log Text
51	Hct/Air Det Slope	AD3
52	Hct/Air Det Instability	AD3
53	Hct/Air Det Overload	AD3
96	Hardware	AD3 ADC
97	Software	AD3 Math

AD4 Status Codes

Code	Status Screen Text	Error Log Text
51	Hct/Air Det Slope	AD4
52	Hct/Air Det Instability	AD4
53	Hct/Air Det Overload	AD4
96	Hardware	AD4 ADC
97	Software	AD4 Math

Flow Status Codes

Code	Status Screen Text	Error Log Text
71	StdA Flow	StdA Flow
72	StdB Flow	StdB Flow
73	StdC Flow	StdC Flow
74	StdD Flow	StdD Flow
75	Flowtime	Flowtime
76	Sample Flow	Sample Flow
77	Air Flow	Air Flow
78	Back Flow	Back Flow

Control Status Codes

Code	Status Screen Text	Error Log Text
81	Ctrl 1 Flow	Ctrl 1 Flow
82	Ctrl 2 Flow	Ctrl 2 Flow
83	Ctrl 3 Flow	Ctrl 3 Flow

System Status Codes

Code	Status Screen Text	Error Log Text
91	Barometer	Barometer
92	Printer	Printer
93	Temperature	Temperature
94	Communication	Communication
95	Hardware	PEROM Write
95	Hardware	PEROM Read
95	Hardware	PEROM CRC
96	Hardware	Hardware
97	Software	Software
99	Scheduled QC Not Run	Scheduled QC Not Run

RMS Status Codes

Code	Status Screen Text	Error Log Text
688	N/A	Software (Pack Not Present)
690	N/A	Software (Pack Empty)
691	N/A	Software (Pack Lot Date Expired)
693	N/A	Software (Pack Use Life Expired)
694	N/A	Communication Error

CMS Status Codes

Code	Status Screen Text	Error Log Text
696	N/A	Software (Pack Not Present)
698	N/A	Software (Pack Empty)
699	N/A	Software (Pack Lot Date Expired)
701	N/A	Software (Pack Use Life Expired)
702	N/A	Communication Error

Standards Information:

Sensor	Standards Used To calibrate	Delta mV Calibration (between standards)
pH	C & D	33
Na^+ (pHOx)	A & D	17
(pHOx+/C/L)	A & C	16
PO_2	Electronic 0.00 / Room Air, Std A used for 1 pt Ca^{++}	
PCO_2	A & B	17
Insert sheet shows HCO_3^- value. HCO3 x 1.5=CO_2 in mmHg		
Hct& ADET's	A & D	(all ADET's) > 500 Hct ideal > 800
(Hb) Based on SO_2 & Hct (mV not shown)		
SO_2	External Stds 1 & 2	n/a
K^+	A & C	24
iCa	A & D	12
Cl^-	A & C	15
Gluc	A & C	38-55
Lact	A & C	35-50

4.3.1 Analyte Troubleshooting (Series code 1-6 and Digit codes 1-4)

Multiple Channel failures:

Slope

- Ensure the Reagent Pack is fully plugged in.
- The pack box edge closest to you should lie inside the small lip of the chassis.
- Check the flow times displayed on the service screens.
- Inspect the Reference tubing to assure flow.
- Inspect the waste line for bubbles.
- Prime the system, check each fluid for air.
- pH and Na^+ require a working reference electrode.

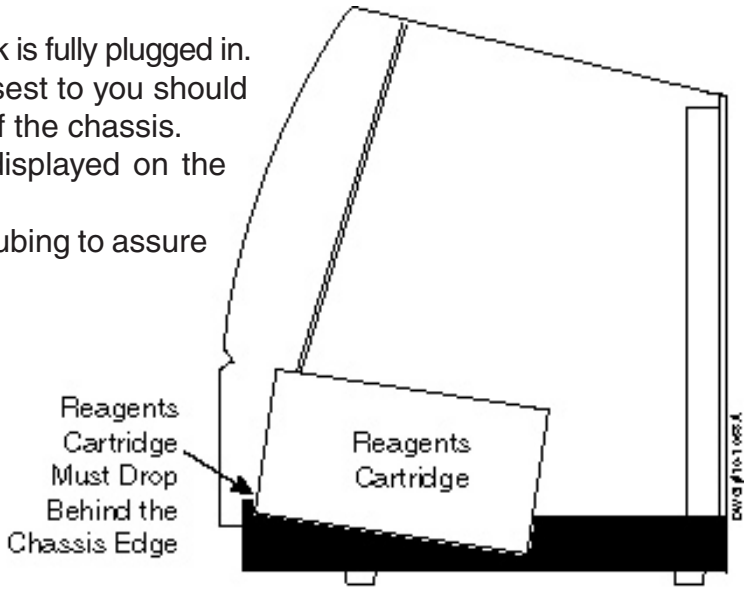


Figure 4-1 Reagent Pack Placement

- Note if the channels that fail use the same standard from the fluid pack.
- Loss of the +5 Vdc on the analog board
- Loss of the Analog board A/D/ converter
- Loss of +5 Vdc to the Analog Board
- Analog Board over heated (PTC resister open) - If unit is allowed to cool off by shutting it off for 5 minutes. Investigate why the unit or Analog board is overheating.

Dependency Rules

- Hct requires calibrated Na^+ for calibration and results.
- PCO_2 requires calibrated pH for results (pH checked on standards to assure bicarbonate is correct).
- SO_2 requires calibrated Hct and PO_2 for results. Calculated SO_2% is reported if measured SO_2 is not available.
- Hb requires Hct and SO_2 for reporting.
  Priority:
  1. If linked with COOX, the COOX HGB is reported.
  2. If no COOX link, the measured result is reported, if available.
  3. If no COOX or measured result, the calculated result from the Hct reading (Hct/3) is reported.
  4. If no COOX, no measured, and no Hct, the default value (Hb) is reported.

- *P*50 is measured and is reported only when PO_2 is between 30-75 mmHg. *P*50c is reported when PO_2 is outside those limits. *P*50 also requires calibrated SO_2% and Hb/Hct for reporting.
- Qsp/Qt requires 2 separate blood samples for determination: mixed venous and arterial.
- RI utilizes input or default FIO_2% for calculation.
- Calculated Results require calibrated and proper results by measured tests used in the calculation.
- Suppression rules - If measured test is suppressed in the Setup, the calculated results based on test also will not be shown or printed.
- Password (One) is used for Setup, Service Menu, and QC. (No user passwords are available.)
- Interfaces are NOVA COOX, PDM, and ASTM.
- Standby Mode:
  There is no time dependency. Analyzer will prime and calibrate after coming out of standby.
  Idle pumping is active, but no fluidic or gas calibrations are performed.
  Features Auto-Wake-Up, Auto-Cal, and Auto-QC
- Micro Sample Analysis:
  Micro-Mode Tests: pH, PCO_2, and PO_2
  Stepped Analysis: Stage 1 = Tip of probe to ADT1 (40 µL)
  Stage 2 = Up to ADT3
  Stage 3 = Between ADT3 (up to ADT4): Other Tests
  Reading (including contact with reference electrode)

Instability

- Inspect sensor module for bubbles during the measurement cycle
- Ensure that the waste valve stops the fluid flow during analysis. Fill the flow path with any standard, raise the probe to the syringe position
  Look for droplets forming at the sampler tip.
- Ensure that the waste and Reference solenoid valve are functioning.
- Fill the flow path with any standard and view the system test screen.
  The signals should be steady and there is no flow of fluid there are three Possible conditions, a loose sensor module, an analog board failure, or a poor connection between a set of electrodes and an interconnect board.
- Inspect the electrode washers to assure proper alignment. Nonalignment may cause a flow problem.
- In rare cases the tubing harness may have become contaminated. Using the cleaning adapter, flush the system with cleaning agent followed by distilled water.

4.3.2 Single Channel Failures

Slope

View the Sensor Subsystem screens. If the change in millivolts between standards is 0 or less than that mentioned in Section 4.3.1, there are several possibilities:

- Membrane or sensor has reached the end of its use life.
- Bubble of Air is covering the sensing material at the electrode tip.
- The electrode is not making good contact with the Interconnect board contacts.
- Loss of the Analog board multiplexer will cause a zero input to the A/D converter.
- Ensure calibration on required channels: Sodium is required for Hct, Hct is required for SO_2%.
- Viewing the Sensor subsystem screens you note an overload condition (999.9 mv).
- Check for NO connection to the Interconnect board.
- Check the PO_2 / PCO_2 for loss of the Internal Fill solution (membrane rupture).
- Loss of the multiplexer or individual channel circuit on the Analog board.
- The pH electrode may need conditioning.
- Na^+ sensor over 30 days of use. The Na^+ sensor will be destroyed by conditioning.

Instability

Single channel instability is seldom a flow problem unless a standard is unique to a particular channel.

- De-bubble the electrodes.
- Ensure a good connection between the electrode and the Interconnect Board.
- Ensure a good connection between the sensor module and Chassis.
- Ensure the analyzer's door is closed and the ground strap is making good connection.

4.3.3 Temperature Problems

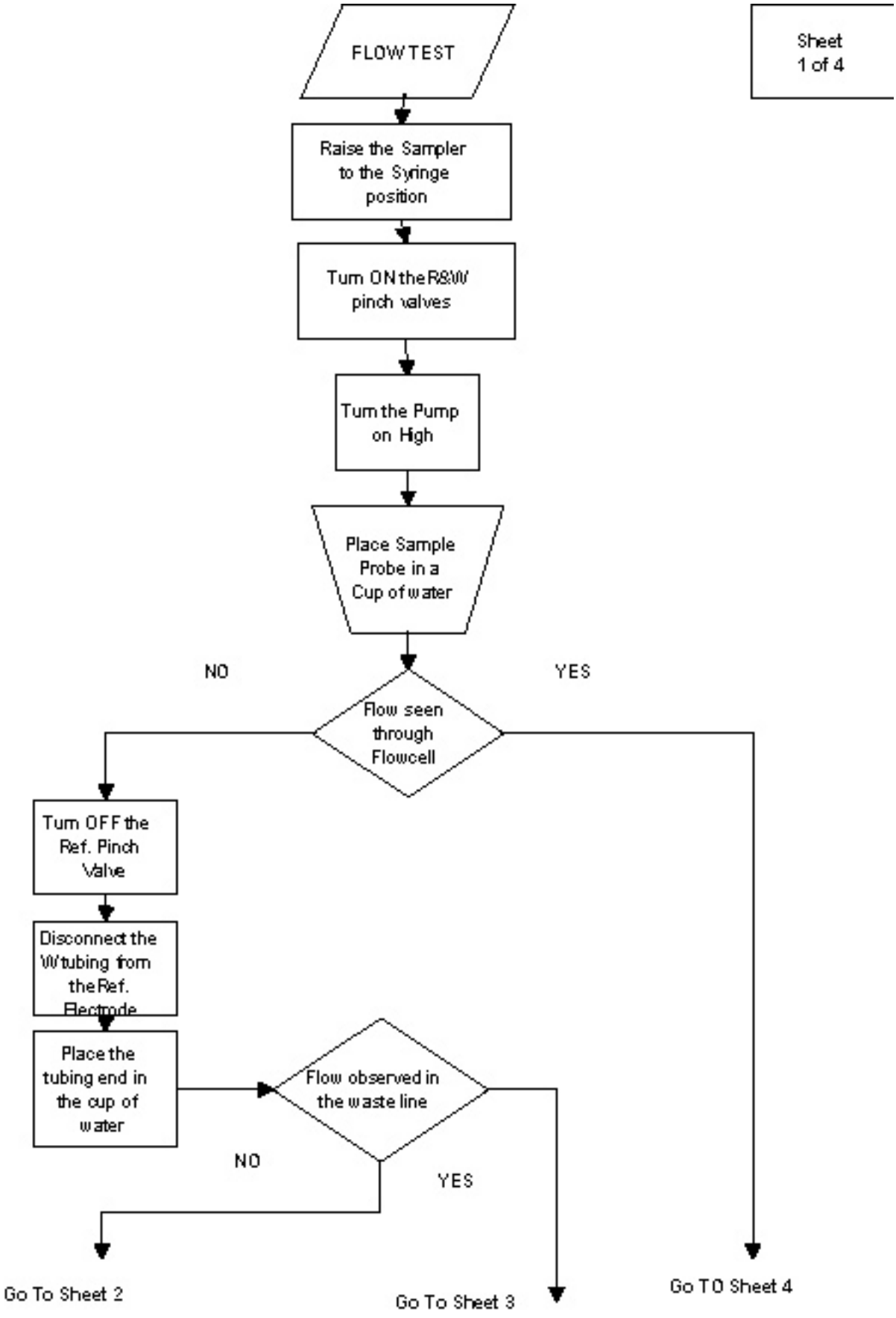
- Ensure that the room ambient temperature is within specification (18º - 32º C).
- Ensure that the sensor module is plugged in correctly.
- View the Analog Input screen channel 20. This channel will be a 0 if the module is at 37º C and change at a rate of 22.5 mv/1ºC, + if above and - if below 37º C.
- The power for the preheater comes from the digital control board.
- The heater control circuitry is on the analog board.

4.3.4 Air Detector (ADT) Problems

- Air Detectors are only calibrated during a 2-point calibration.
- Typically the Fluid /Air millivolt difference will be about 700.
- Check the sample probe for air being introduced below the sensor module.
- Check the sensor module for air being introduced at the electrode/sensor module seal.
- Ensure that the electrode sealing washers are centered and seated correctly.
- The Air detector signals are processed by the analog board. They are only displayed on the System Test screen. Alternately aspirate air and then fluid to see the change in the signal.

NOTE: *Remember to turn on the air oscillator to obtain an ADT reading.*

- Flow Test
  - During a flow test, the rotary valve rotates to each fluid position.
  - The pump turns on to fill the lines from the rotary valve S-line port to the ADT1.
  - The rotary valve rotates to an air position.
  - The pump turns on and the time in milliseconds until the ADT senses air is recorded.
  - The time is normally 1200 msec. The acceptable range is 100 to 1700 milliseconds.
- Run a Flow Test; press the soft key on the Service screen.
  - Typical result for Standard A, B, C, D is 1300.
  - If all are high (3000-5000), there is a flow path obstruction.
  - If only one is high,
    1. Check for correct fluid pack installation.
    2. Check that the valve is in the correct position.
    3. Connect a syringe to the S-line port of the valve. Remove the reagent pack and move the valve to each position. Verify that the link is clear by purging air through the S-port.


FLOW TEST
Sheet 1 of 4
Raise the Sampler to the Syringe position
Turn ON the R&W pinch valves
Turn the Pump on High
Place Sample Probe in a Cup of water
NO
YES
Flow seen through Flowcell
Turn OFF the Ref. Pinch Valve
Disconnect the W tubing from the Ref. Electrode
Place the tubing end in the cup of water
Flow observed in the waste line
NO
YES
Go To Sheet 2
Go To Sheet 3
Go TO Sheet 4

No Flow in W/R line from Sheet 1

Flow Test Sheet 2

Lift the tubing from the Waste Pinch valve

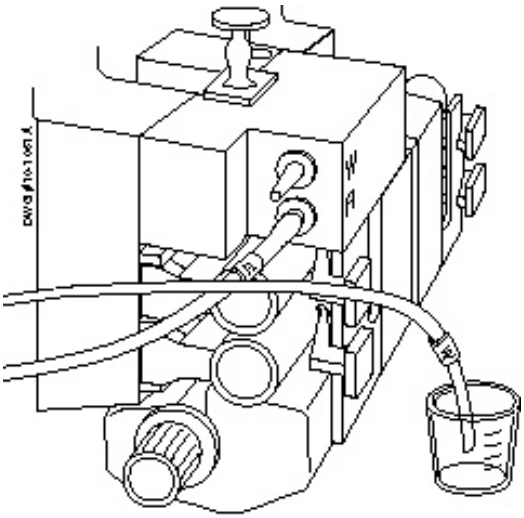
YES

Flow observed in waste line

NO

Clean dirt from the valve slot or Replace valve

Disconnect the W/tubing from the front panel fitting



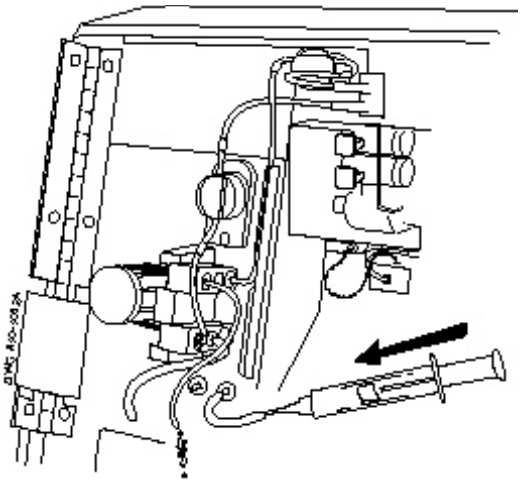
NO

Flow coming out the pump outlet tube

Replace the W/R tubing

YES

Stop the Pump



Connect a syringe of water to the front panel waste fitting

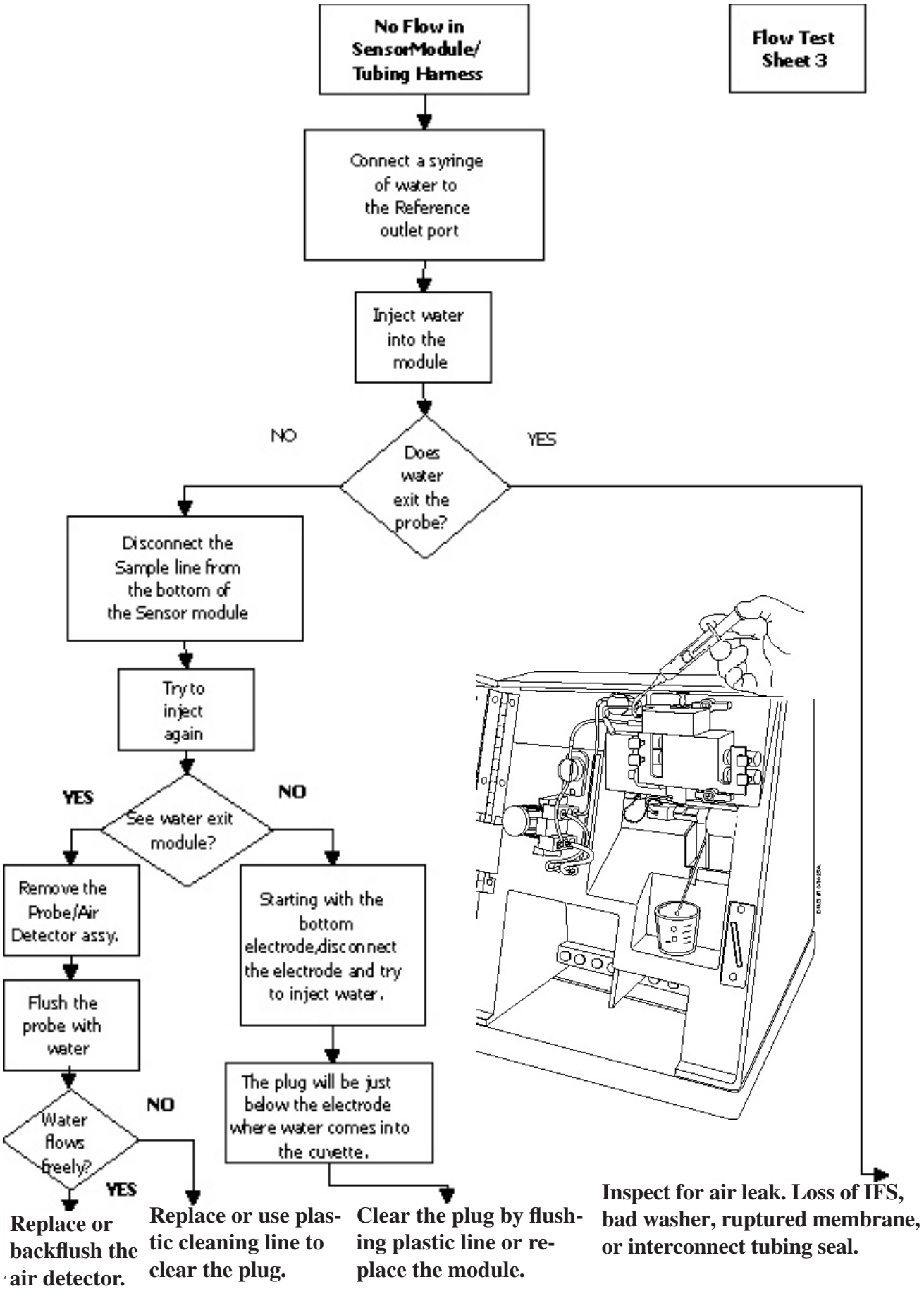
NO

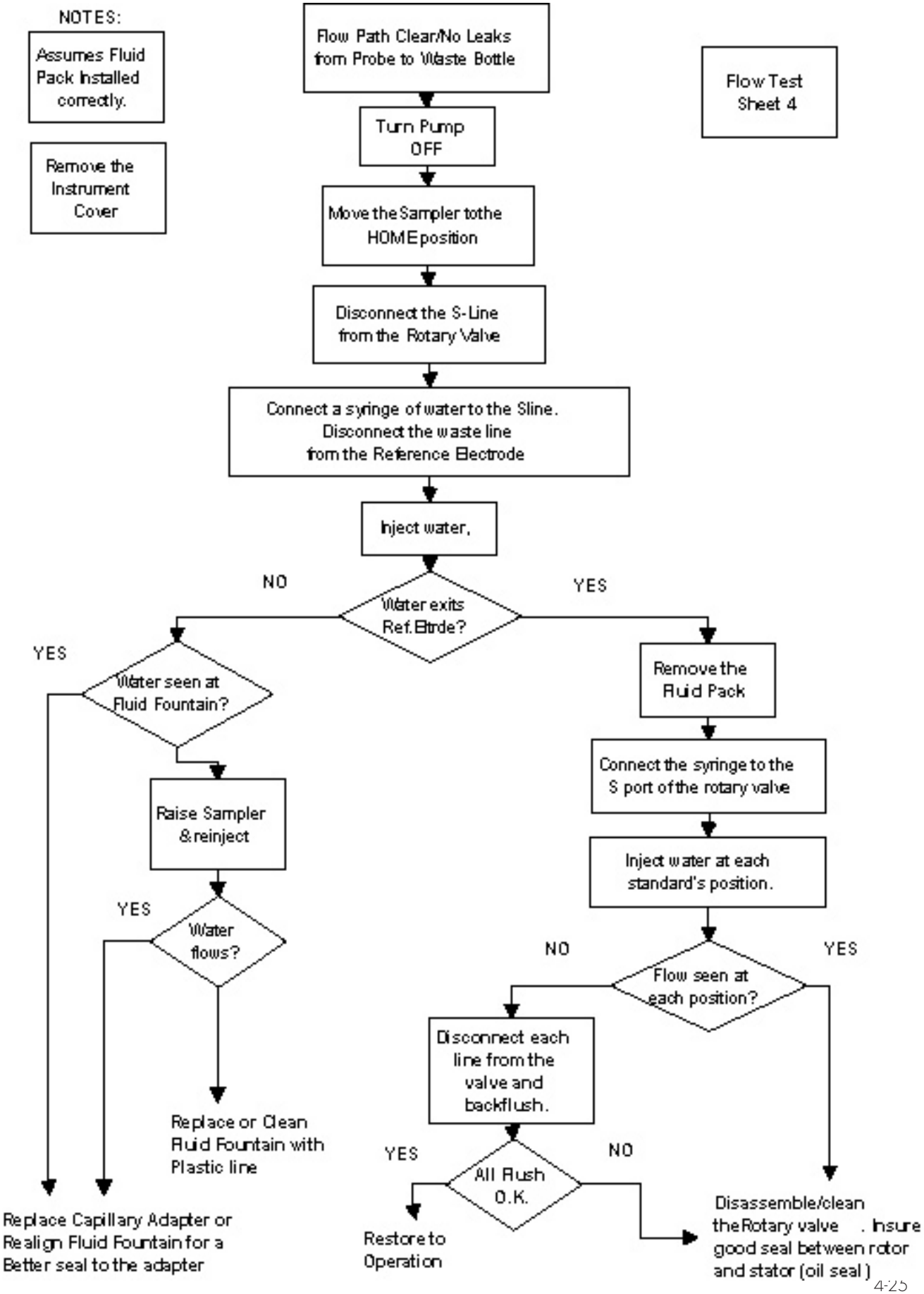
Water may be injected into the port?

YES

Replace the internal tubing set

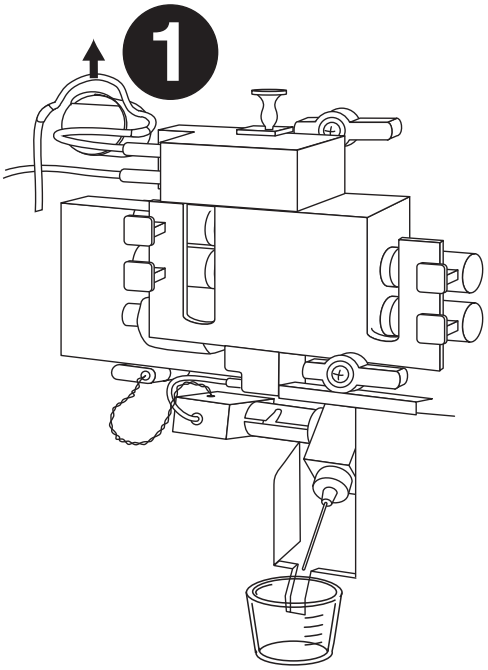
Plug is cleared Restore operation

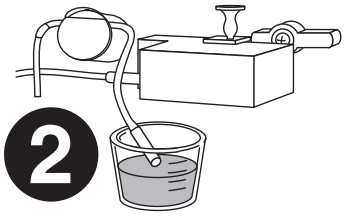

No Flow in SensorModule/ Tubing Harness
Flow Test Sheet 3
Connect a syringe of water to the Reference outlet port
Inject water into the module
Does water exit the probe?
NO
YES
Disconnect the Sample line from the bottom of the Sensor module
Try to inject again
See water exit module?
YES
NO
Remove the Probe/Air Detector assy.
Flush the probe with water
Water flows freely?
NO
YES
Starting with the bottom electrode,disconnect the electrode and try to inject water.
The plug will be just below the electrode where water comes into the cuvette.
Replace or backflush the air detector.
Replace or use plastic cleaning line to clear the plug.
Clear the plug by flushing plastic line or replace the module.
Inspect for air leak. Loss of IFS, bad washer, ruptured membrane, or interconnect tubing seal.

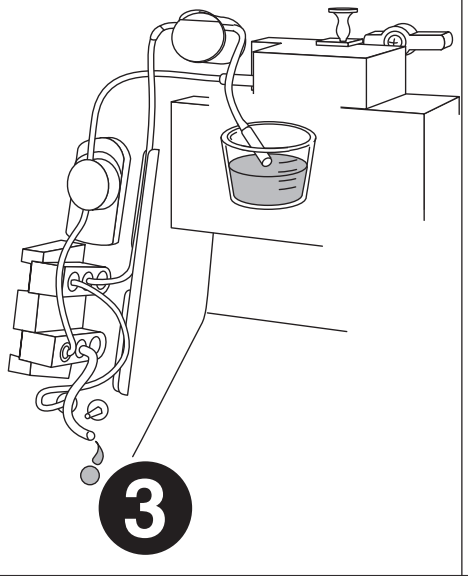

NOTES:
Assumes Fluid Pack Installed correctly.
Remove the Instrument Cover
Flow Path Clear/No Leaks from Probe to Waste Bottle
Flow Test Sheet 4
Turn Pump OFF
Move the Sampler to the HOME position
Disconnect the S-Line from the Rotary Valve
Connect a syringe of water to the Sline. Disconnect the waste line from the Reference Electrode
Inject water,
Water exits Ref. Elctrde?
NO
YES
YES
Water seen at Fluid Fountain?
Raise Sampler & reinject
YES
Water flows?
Replace or Clean Fluid Fountain with Plastic line
Replace Capillary Adapter or Realign Fluid Fountain for a Better seal to the adapter
Remove the Fluid Pack
Connect the syringe to the S port of the rotary valve
Inject water at each standard's position.
NO
YES
Flow seen at each position?
Disconnect each line from the valve and backflush.
YES
All Flush O.K.
NO
Restore to Operation
Disassemble/clean the Rotary valve . Insure good seal between rotor and stator (oil seal)

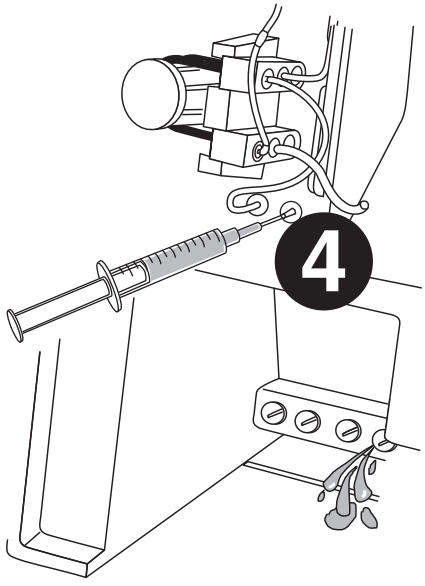
Operator Flow Test

From Ready→Service→System Test→Customer Flow Test









1 - Lift the tubing out of the Waste solenoid.
- If tubing remains pinched, roll it between fingers to loosen.
- Place the sample probe in a cup of water.

Is fluid flow noticed in the waste line tubing?

A. IF YES, call your Nova Service Representative.
B. IF NO, go to Step 2.

2 - Disconnect the Waste (W) from the Reference Electrode.
- Place this end of the W tubing into a cup of water.

Is fluid flow seen in the Waste line tubing?

A. IF YES, press "PUMP" to turn off the pump motor. Go to the other side of this page, "Sensor Module Back Flush" procedure.
B. IF NO, go to Step 3.

3 - Disconnect the Waste line tubing from the front panel port.
- Place this end of the tubing over gauze to prevent spilling.
- Aspirate water from the same location as in Step 2 above.

Is fluid seen exiting the Waste tubing end you just disconnected?

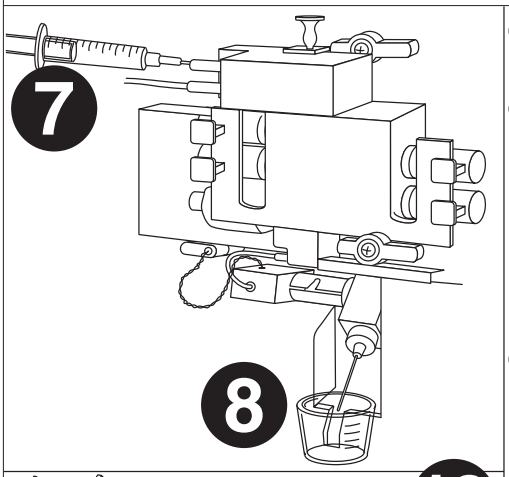
A. IF YES, go to Step 4.
B. IF NO, Replace the W/R Tubing Harness (REF 23023)

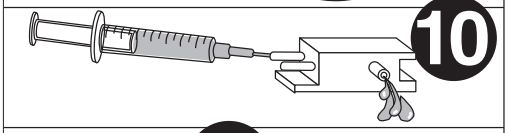
4 - Press the "PUMP" key to stop the Pump Motor.
- Remove the Calibrator Cartridge from the unit.
- Install the flush adapter.
- Place the flush adapter tubes into an empty beaker.
- Inject water into the front panel Waste port.
- Water should flow through the adapter waste tube. (Adapter waste line is last to the right)

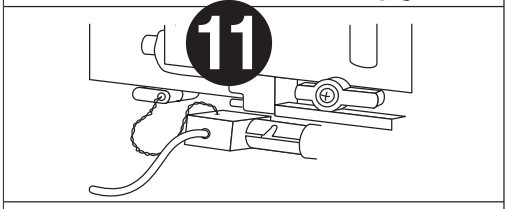
* Loss of Reference flow will change the flow rate. Reference solution will flow at a rate of 1 -2 drops/second during a pumping cycle.

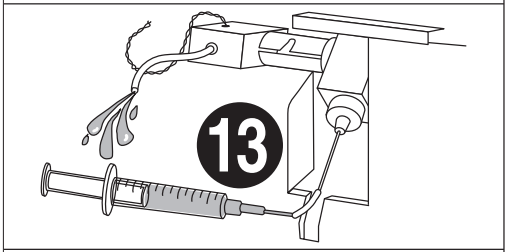
** If this tubing cannot be flushed call your Nova Service Representative. If tubing flushes easily, change the Calibrator Cartridge. In a small number of cases the original problem may have been poor alignment of the Calibrator Cartridge.

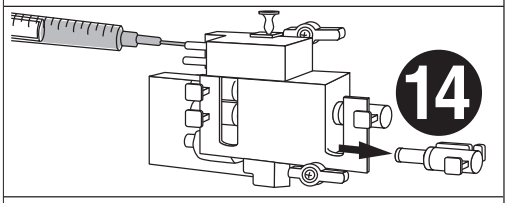
Sensor Module Back Flush Procedure

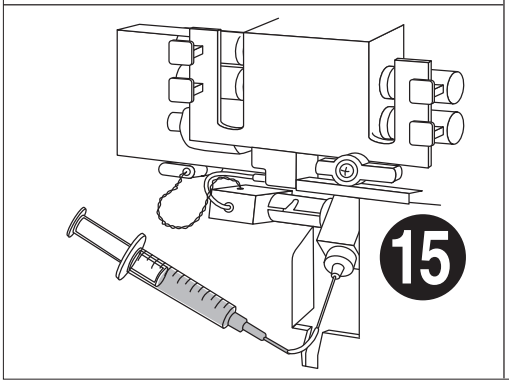












⑤ If you are starting from the Operator Flow Test
-Turn the Pump OFF by pressing the "PUMP" key.

⑥ If you are starting from the Ready Screen
- Press Service, System Test and select the Operator Flow Test.
- Turn the pump OFF as in Step 5.

❼ Connect a syringe filled with water to the Reference Electrode waste port.

❽ Back flush the flow path by injecting the water.
Caution: Place gauze or towel at the sample probe tip to receive the obstruction or water.

⑨ If the water easily flushes through the sensor module, you may have an air leak into the flowpath. This will be from an interconnect tubing, failed membrane, or poorly seated sensor. Go to Step 15.

❿ If water does NOT exit the sample probe
- Lift the Reference Electrode off the sensor module.
- Flush the Reference Electrode.
If it flows freely, confirm that the interconnect tubing is properly positioned and reinstall the Reference Electrode.

⓫ Disconnect the Air Detector from the bottom of Sensor Module.

⑫ Inject water into the W port of the Reference Electrode. Does water flow through the sensor module?
A. IF YES, go to Step 13.
B. IF NO, go to Step 14.

⓭ - Connect the syringe to the Sample Probe tip.
- Inject water through the Probe.
Water should exit the Air Detector (ADT) tubing.
IF NO flow is noted, flush the ADT and probe separately.
IF the water flows easily, the seal between the ADT and probe may be leaking. Replace the Air Detector.

⓮ (NO from Step 12) The obstruction lies in the flowcell. While continuing to inject, remove one sensor at a time, starting with the bottom sensor. When water starts to flow, either the obstruction flushed into the flowcell or the sensor just removed was the cause. Re-membrane if needed. Dry the flowcell before re-inserting the sensor.

⓯ (From Step 9) Connect the syringe with water to the sample probe tip. Reconnect the Reference Electrode Waste line. Apply a slight pressure to the syringe. Look for water entering a flowcell, sensor cap, or leaking from the interconnect tubing. Replace the membrane, or tubing as required.

If the above does not identify the problem, please contact your Nova Service Representative.

A Appendix

A.1 Quick Reference Guide

Measured Tests:

pH, PO_2, PCO_2, SO_2%, Hb/Hct, (Na^+ is not reported)

Calculated Tests:

- A — Alveolar Oxygen Concentration
- a/A — Arterial Alveolar Oxygen Tension Ratio
- A-aDO_2 — Arterial Alveolar Oxygen
- BEecf — Base Excess, Extracellular Fluid
- BEblood — Base Excess, Blood
- HCO_3^- — Actual Bicarbonate Concentration
- O_2Ctc — Oxygen Content
- P50c — P50 Calculated (when PO_2 is <30 or >75)
- Qsp/Qt — Physiologic Shunt
- RI — Respiratory Index
- SBC — Standard Bicarbonate
- SO_2%c — Oxygen Saturation % (Calculated)
- TCO_2 — Total Carbon Dioxide
- Temp — pH/PCO_2/PO_2 (Temperature Patient Corrected, if selected)

Slope Limits:

pH	9.1 to 11.6	(1,7)	PCO_2	7.9 to 12.6	(1,2,4,8)
PO_2	-15.0 to -1.6	(1,2,4,8)	SO_2%	6.9 to 18.2	(1,5,8)
Na^+	8.8 to 11.5	(1,7,8,9)	Hct:	12.0 to 50.	(1,6,7)

Electrode Notes:

1 = Long Life Sensor
2 = Int'l Ref Electrode
3 = Membrane Cap; Push-On
4 = Membrane Cap; Screw-On
5 = Reflectance
6 = Impedance
7 = No Washer
8 = Internal Washer
9 = Non-Reported Test
10= Obtained from SO_2% and Hct

Flow Limits:

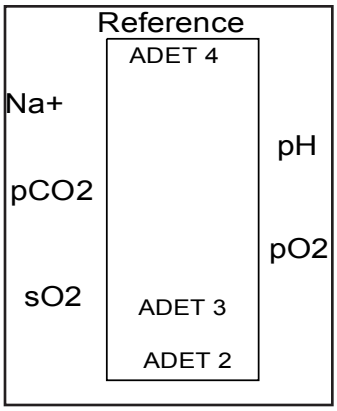
Flow Test (Service Menu): Typical/Ideal Value = 1300 (milliseconds)
** High Values (ie: > 3000) or "ERROR" note on Std Channel:
Indicates major flow blockage.

Offset Limits (Slope/Intercept):

Test	*Y-Intercept Range*	*Slope Range*
pH	+/- 100 mpH	NONE
H+	NONE	0.8 to 1.2
PCO_2	+/- 10 mm Hg	0.8 to 1.2
PO_2	+/- 20 mm Hg	0.9 to 1.1
SO_2 %	NONE	0.9 to 1.1
Hct	+/- 10.0 %	0.8 to 1.2
Hb	+/- 2.0 g/dl	0.9 to 1.1

Flow Cell Positions:

Top	Reference Biosensor
Adet 1	Located above Sample Probe Used to detect 40 uL MicroSample
Adet 2	In Sensor Mod/Flow Cell Used to detect 70 uL sample
Adet 3	Reads Hct, then blood pulled up and air is seen telling stop for electrode sample reading; sample position
Adet 4	Positions top of sample for electrode readings



Calibration Details (Analysis Time/Throughput):

Two Point Calibration:	User Selects (not auto control), 2,4,6 hour intervals (turned off in Standby Mode).
One Point Cal:	User selects for 30 or 45 minutes (same as STP/UL), One point cal for ALL (gases plus pH/Hct), One point SO_2 done with each full 2-point calibration.
Standard One Point Cal:	Done with blood samples: Single Mode (each sample); NOT available with product release; will be for low volume users only.

Throughput Details: **Throughput specs subject to change without notice due to software sequence changes.**

pHOx/B:

Analysis Cycle:	Mode A = 44 sec.; Mode B = 64 sec (time to view results)
Run Time:	Mode A = 62 sec; Mode B = 74 sec (full cycle)
Throughput:	Approx 50/Hour (varies by mode)
Micro Mode:	Analysis (view) = 43 sec; Run Time = 65 sec.

pHOx+C:

Analysis Cycle:	Mode A = 47 sec.; Mode B = 100 sec (time to view results)
Run Time:	Mode A = 65 sec; Mode B= 109 sec (full cycle)
Throughput:	Approx 33/Hour (varies by mode)
Micro Mode:	Analysis (view) = 45 sec; Run Time = 65 sec.

pHOx+-L:

Analysis Cycle:	Mode A = 60 sec.; Mode B = 126 sec (time to view results)
Run Time:	Mode A = 89 sec; Mode B= 134 sec (full cycle)
Throughput:	Goal: 25-30/Hour
Micro Mode:	Analysis (view) = 71 sec; Run Time = 95 sec.

Default Values:

Hb	14.5 g/dL	(Range 10.0 to 20.0 g/dL)
Temperature	37 ° C	(Range 10.0 to 40.0°C)
FIO_2 %	20.9 % (room air)	(Range 20 to 100.0%)

Sample Volume:

Regular Mode	70 uL	pHOx/B	(all tests)
	115 uL	pHOx-Plus	(all tests)
	120 uL	pHOx-Plus L	(all tests)
Micro Mode	40 uL	pHOx/B	(gases)
	55 uL	pHOx-Plus- Plus L	(gases)

Software Version: 4.xx

Sample Type:

Arterial, venous, capillary, mixed venous, Quality Controls, and Proficiency

One-Point Cal Modes:

Mode A One point fluid cal performed with each Gas Cal I (30-45 min intervals). (Best for medium-high volume customers)

Mode B One point fluid and Gas Cal performed with EACH analysis. (Best for LOW volume customers only - No separate Gas Cal I)

Rotary Valve Positions:

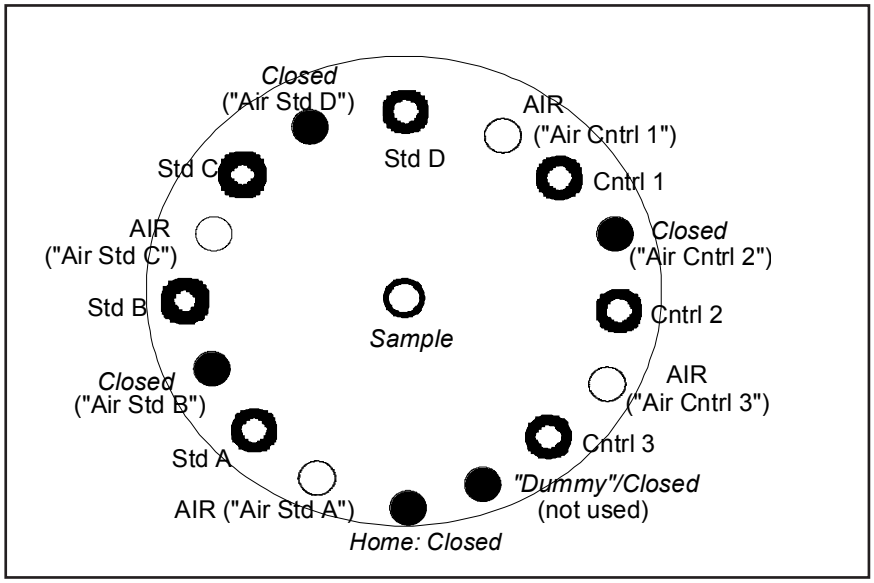


Figure A-2 Valve Manifold Assembly (Tubing Connections and Rotation Positions)

Control/Position Valve Manually and View Positions: Service Menu, System Test

AIR Positions:	Air Std A, Air Std C, Air Cntrl 1, Air Cntrl 3
Closed Positions:	HOME, Air Std B, Air Std D, Air Cntrl 2, Dummy
Fluid Positions:	Std A Std B Std C Std D
Connections on Valve:	(A) (B) (C) (D)
Control (Fluid) Positions:	Cntrl 1 Cntrl 2 Cntrl 3
Connections on Valve:	(E) (F) (G)
Not Used Position:	Dummy

Linear (Measurement) Ranges:

pH	6.50 to 8.00 pH units	
PCO_2	3.0 to 200 mmHg	(0.4 to 26.7 kPa)
PO_2	0 to 800 mmHg	(0.0 to 106.7 kPa)
SO_2%	0.0 to 100%	
Hct	12% to 70%	
Hb	4 - 23.3 g/dL - based on Hct	
Na^+	not reported - 1.0 to 200.0 mmol/L)	

Memory Storage Capability:

Patient Storage	18 Samples (FIFO)
QC Storage	6 QC Files (FIFO)
	Stores up to 10 daily points/level - condensed to 1 monthly point
	Monthly Data - 32 points for each level
Error Codes	96 total codes stored (FIFO)
	6 shown per screen (16 potential screens)

QC Files Details:

6 QC Files plus “File 0” (proficiency)
- 3 On-Board QC files (combined gases/Hct/SO2 controls; 3 levels)
- 3 External QC files (3 levels for BG; 2 levels for Hct/SO2)

Features: Auto QC (on-board QC) w/ preset times; Control reminder/lockout; Setting daily QC analysis times.

Tracking: Daily, Monthly, Cumulative, Levey-Jennings.

Fluids Details:

Std A - It is used to calibrate PCO_2, Na^+, Hct, and PO_2 (1-point check) and sits in flow cell during idle.

Std B - It is used to calibrate PCO_2, contains surfactant, and is used to clean flow path during cycles.

Std C - It is used to calibrate pH.

Std D - It is used to calibrate pH, Na^+, and Hct.

External SO_2 Calibrators - There are 2 levels used to calibrate SO_2 (approx 50 and 95 %; final values TBD). Calibrate monthly (or as needed).

Dependency Rule and Setup Information:

HCT Requires Na^+ calibrated for calibration/results.

PCO_2 Requires pH calibrated for results. (pH checked to assure bicarbonate is correct.)

SO_2% Requires Hct calibrated, uses SO_2%c if measured SO_2 is not available.

Hb Requires Hct and SO_2 for reporting.

Hb method priority:

(1) If linked with COOx, then COOx Hb will be reported.

(2) If no COOx link, measured results are reported (if available).

(3) If no COOx or measured result, calculated result from Hct reading (Hct/3) is reported.

(4) If no Coox, no measured, and no Hct: Reports 'Default' Value (Hb).

$P50$ Measured Reported only with PO_2 between 30 and 75 mmHg. Also requires calibrated SO_2% and Hb/Hct for reporting.

Qsp/Qt Requires 2 separate blood samples for determination: Mixed Venous and Arterial.

RI Utilizes input or default FIO_2 % for calculation.

nCa pHOx-Plus Only. Requires properly installed/calibrated iCa and pH.

Anion Gap pHOx-Plus Only. Requires properly calibrated/installed Na^+,K^+,Cl^-, PCO_2.

Calculated Results require calibrated and 'proper results' by measured tests used in calculation.

Suppression (Hb): Only Hb can be suppressed: Option to turn Hb from measured to calculated (one or the other will always appear).

Passwords:

- One password (System Password) for Set Up
- 200 user unique passwords available - 3 levels of priviledge:
  1. Privilege Level 1: Operators have access to all areas of the analyzer except those protected by the existing System Password. Level 1 operators do not require PDM review and may override this feature. Level 1 operators can override QC lockout.
  2. Privilege Level 2: Operators have access to all areas of the analyzer except those protected by the existing System Password. Level 2 operators DO require PDM review, but may override this feature. Level 2 operators cannot override QC lockout.
  3. Privilege Level 3: Operators have access to analysis only. Level 3 operators require PDM review and cannot override this. Level 3 operators cannot override.

Test Suppression:

If measured test is suppressed, any calculated/associated tests will also be suppressed. Tests still will be calibrated w/errors displayed on suppressed channels.

Interfaces:

NOVA COOX, PDM, ASTM interfaces.

Standby Mode:

No time dependency will prime and calibrate after coming out of Standby,
In Standby only does idle pumping, no fluidic/gas calibration,
Auto-Wake-Up, Auto-Cal, and Auto-QC

Micro-Sample Analysis:

Micro-Mode Tests: pH, PCO_2, PO_2
Stepped Analysis: Stage 1 = Tip of Probe to Adet 1 (45/55 uL
Stage 2 = Up to Adet 3.
Stage 3 = Between Adet 3 (up to Adet 4):
Other Tests Reading (including contact with Reference Electrode)

QC Lockout:

Mode A Lockout:

If lockout enabled, and tests fail, unit can be 'unlocked' by running any control level and passing all tests.

Mode B Lockout:

If lockout enabled, and tests fail, unit can only be 'unlocked' by running specific control level(s) that failed and passing all tests.

QC Storage Options:

Mode A QC Storage:

If all QC results 'pass' range limits, QC results are automatically stored in memory. If any results 'fail' range limits, all results will remain on unit display until either user accepts/rejects results or another QC or sample result is run/displayed (at which time past [non-released] QC results) will be deleted.

Mode B QC Storage:

All QC results, whether passing or failing range limits are automatically stored in memory at end of control analysis.

Glucose (Overrange Testing) pHOx-Plus/C/L only:

Gluc Overrange Solution included in Reagent Pack: Done Automatically Daily;
Elimination of manual - ampule running of Performance Check Solution
Automatic Glucose Performance done at operator-programmed time daily.
(Nova recommends to set time at 5:00 AM for optimum performance.)
PASS - FAIL is reporting. Change Gluc Membrane if test lists as FAILED and repeat.

Glucose Auto Polishing Cycle: Automatic polishing of Gluc sensor occurs each day at midnight, followed by 2-point cal, and additional 2-pt calibrations at 2 and 4 AM.

Error Code Overview:

Code Groups Summary

Group: 1 - 6	pH
Group: 7 - 13	PCO_2
Group: 14 - 19	PO_2
Group: 20 - 32	SO_2%
Group: 33 - 35	Hb
Group: 36 - 42	Hct
Group: 43 - 48	Na^+
Group: 49 - 53	ADET 1
Group: 54 - 58	ADET 2
Group: 59 - 63	ADET 3
Group: 64 - 68	ADET 4
Group: 69 - 75	Flow-Related
Group: 76 - 78	QC-Related
Group: 79 - 104	Hardware-Software Related
Group: 602 - 684	QC Related
Group: 686 - 703	RMS Reagent Pack Related

(Refer to the reference manual for specific code details.)

A.2 General Maintenance/QC

1. Flowpath Conditioning (AS NEEDED)
   (Use serum/plasma/whole blood - Automated Cycle.)
   (Sales/Customer Typical Information: Customers as below; Sales- Do once at start of demo/evaluation.)
   a. Done daily for low-mid volume users (as needed).
   b. Not required for higher volume users.

2. Control(s) Analysis (DAILY)
   (Sales Information: SetUp QC Files fully before demo/evaluation; Customers: Run QC as they wish.)

   NOTE: *Internal & External Controls are unique for all pHOx models. Controls for pHOx cannot be used on pHOx-Plus or "L", and visa-versa.*

   a. Internal Controls - 3 levels (All Tests including gases and SO_2)
   b. External Controls - 3 levels in Multi-Pack Only (pHOx/B =All Tests inc. SO_2 & Gases; pHOx+/L = All Tests, inc. electrolytes/Glu/Lac)

3. Glucose Overrange Solution (Analysis) pHOx+/L/C Only (DAILY)
   (Sales Information: Verify Performance Chk passes- AutoRun at start of demo/evaluation & at each followup)
   Software Versions 2.0.x or Higher
   (Elimination of manual-ampule running of Performance Check Solution.)
   Automatic Glucose Performance done at operator-programmed time daily.
   PASS - FAIL reporting: Change Gluc Membrane if test lists as FAILED then repeat test.
   For Failed Test: Gluc is BACKLIT on Ready screen indicating failure; tests are unavailable for use until resolved.

4. Flowpath Cleaning (MONTHLY)
   a. For product release: Do monthly.
   b. Automated aspiration cycle, use Deproteinizing Solution.
   c. For pHOx only, remove Na^+ electrode (non-glass sensor) and use a blank electrode.

5. Calibrate SO_2 Channel pHOx/+/L/C (MONTHLY)
   a. Calibrate using 2 external Calibrators (latex suspension).
   b. Do monthly or more frequently as needed.

6. Clean SO_2 Sensor (Optics) Surface: (pHOx/+/L/C) (QUARTERLY)
   a. Wipe optics surface of SO_2 Sensor with lint-free tissue soaked with Cleaning Solution or 10% Bleach. Rinse with H_2O.

7. Replace Na^+ Electrode pHOx (AS NEEDED)
   a. Required to be done based on slope or results performance.
   b. Correct Hct QC is NOT reliable indicator of Na^+ channel performance.

   Condition Na^+ Electrode pHOx+/L/C (AS NEEDED)
   a. Required to be done based on slope or results performance.
   b. Use Na^+ Conditioning Solution (PN 36856). Remove Na^+ and soak in Conditioning Solution for 2 minutes.

8. Electrode Maintenance Details

   pH Electrode
   - Condition (manually) troubleshooting w/ pH Cond Soln (PN 06856); 10 min soak.
   - NO need to condition at start of use (Cond Soln in electrode pouch: pre-soaked)
   - Long-Life Sensor (similar to Stat Profile M)
   - Expected Lifetime: 1-2 Years; Warranty = 6 months from installation

PO_2 Electrode

- Screw-On Membrane Cap (w/ Washer attached)
- Polish electrode (manually) (10 sec. circular on paper) w/ each membrane change.
- Electrode = Long Life; Membrane = Short Life
- Electrode estimated life = 1-3 Years; Membrane estimated life = 1-5 months
- Warranty: Electrode: 6 months; Membrane: Free of defects at installation
- Blood Condition after new electrode is installed (membrane changed as needed).
- Prefilled Membrane Caps (no IFS addition required or to be added)

PCO_2 Electrode

- *Screw-on Membrane Cap (NEW Version; Different than STP/UL); washer attached.*
- *Membrane Life (new membranes/sensors = 2-12 weeks*
- *NO Conditioning (*PCO_2 Condition Solution*) at StartUp (Caps pre-soaked in package)*
- *Electrode = Long Life; Membrane = Short Life*
- *Electrode estimated life = 1-3 Years; Membrane estimated life = 1-5 months*
- *Warranty: Electrode: 6 months; Membrane:* Free of defects at installation
- *Blood Condition after new electrode install, membrane change and as needed.*
- *Pre-filled Membrane Caps (no IFS addition required or to be added)*

Na^+ Electrode

pHOx:

- Short- Life Disposable Electrode. NO maintenance.
- Expected Lifetime: 2-4 months. Warranty = 1 month (from install).
- Do NOT condition with pH Cond Solution (will damage electrode).
- Must remove Na^+ when doing Flowpath Cleaning (use 'blank').

pHOx-Plus/L/C:

- Long-Life Sensor (similar to SP-M)
- Expected Lifetime: 1-3 Years. Warranty = 6 months (from install).
- Condition (as needed): Requires manual soak in Na^+ Conditioning Solution.
- NO need to remove Na^+ (from flowpath) when doing Flowpath Cleaning.

SO_2 Channel pHOx/+/L/C Only

- Clean flow-channel with cotton-tipped swab.
- Wipe optics surface of SO_2 Sensor with lint-free tissue soaked w/ Cleaning Solution or 10% Bleach. Rinse with H_2O. (Quarterly)
- Expected Lifetime: 6-12 Months
  Warranty = 3 months from installation

K^+ Electrode pHOx-Plus/L/C Only

- Mid-life (age) Sensor (similar to SP-M); Max Use Life = 5 months
- Blood/protein conditioning for low-volume customers (as needed)

iCa Electrode pHOx-Plus/L/C Only

- Short-life (age) Sensor (similar to STP-M)
- Expected Lifetime: 1-3 Months; Warranty = 7 days or 300 samples from installation
- Blood conditioning (optional) can improve sensor performance.

Cl^- Electrode pHOx-Plus/L/C Only

- Short-life (age) Sensor (similar to STP-M)
- Expected Lifetime: 1-3 Months; Warranty = 7 days or 300 samples from installation
- Blood conditioning (optional) can improve sensor performance
- No membrane cap; pre-filled/sealed sensor (similar to STP-M)

Glucose Electrode pHOx+/L/C Only

- Electrode Short-life (age) Sensor (similar to STP-M)
- Electrode = Long Life; Membrane = Short Life
- Electrode estimated life = 1-3 Years; Membrane estimated life = 1-4 weeks (replace membrane if Glucose Performance Check fails or slope drops out)
- Warranty: Electrode: 6 months; Membrane: 3 days from installation
- Polish using new YELLOW (1 u) Polishing Paper only.
- NO CONDITIONING (soaking) of Sensor required routinely.
- Polish sensor ONLY FOR TROUBLESHOOTING (not with each membrane change). (Polish AS NEEDED.)
- Polish 10 seconds. (Polish DRY on paper: no water added.)
- Rinse with water; blot dry.
- Replace new membrane directly.
- Condition sensor in Soaking Solution (PN 13409) for 5 minutes with polishing.

Lactate pHOx-Plus-L Only

- Electrode = Long Life; Membrane = Short Life
- Electrode estimated life = 1-3 Years; Membrane estimated life = 1-3 weeks (Replace membrane if Lact Std D Hi or Lo errors occur or slope drops out.)
- Warranty: Electrode: 6 months; Membrane: 3 days from installation
- Polish using new YELLOW (1 u) Polishing Paper only.
- NO CONDITIONING (soaking) of Sensor required routinely.
- Polish sensor ONLY FOR TROUBLESHOOTING (not with each membrane change). (Polish AS NEEDED.)
- Polish 10 seconds. (Polish DRY on paper: no water added.)
- Rinse with water; blot dry.
- Condition sensor in Soaking Solution (PN 13409) for 5 minutes with polishing.

A.2.1 Other Analyzer Maintenance

1. Tubings Details
   a. Pump Tubings — QUARTERLY
      May need more frequent changes due to any flow-related problems.
   b. External Tubings: Waste/Reference Lines (through Solenoids) — YEARLY
   c. Other External Tubings — YEARLY
   d. Internal Tubings (Manifold) — YEARLY
      (done only at time of PM by field engineer)

2. Analyzer Shutdown — AS NEEDED
   a. Short-Term (<2 Hours)
      - Power-off the analyzer
      - No need to rinse/clean unit for this period of time

   b. Long Term (> 48 Hours)
      - Requires water and air purge of flowpath and all reagent lines
      - Utilize special Purge Manifold to attach to reagent needle ports and place
      - Put all lines (except waste) in distilled water. Process 2-3 fluid primes with water.
      - Then remove lines from water and leave open to air; process 2 fluid primes with air.
      - After air prime, unit may be shut-off and remove electrodes as needed.
      - Take pump tubing off pump roller to relieve tubing tension.

A.3 pHOx Electrode/Standards

Electrode	Standards Used in Calibration/Slope	Approximate Delta mV (between standards)
pH	Stds C & D	33
Na^+	Stds A & D	17
PO_2	Stds Room Air, Std A and 0 (Ratio Air to Fluid (A) for 2 pt Cal; Std A used for 1 pt Cal)	Not Shown (Air to 0) 1 (typical ratio Air/A) (should be almost same)
PCO_2	Stds A and B (HCO_3- for dissolved gas>>monitor pH)	17
Hct and ADET's	Stds A and D (all ADET's)	> 500 (Adet 3 = Hct) (ideal > 800)
Hb	Based on SO_2 and Hct	TBD
SO_2%	External Stds 1 and 2	n/a

A.4 Electronics and Mechanicals Overview

Electronics
Circuit Boards and Main Assemblies

NOTE: *Almost all circuit boards on the pHOx utilize surface-mount technology, therefore board component repair is not recommended except for socketed chips.*

- Analog Board/Sensor Board
- Digital/Controller Board
- Display Assembly

- Distribution Board
- Electrode (Left and Right) Interconnect Boards
- Keypad
- Power Entry Module
- Power Supply Assembly
- Printer Printhead and Printer Interface Board
- SO_2 Sensor Board

A.5 Shutdown Procedure

If the analyzer is to be turned off for more than 24 hours, flush the tubing harness first with distilled water then with air. Use the Flush Fixture (PN 24327) to perform this procedure.

1. Remove the Reagent Pack from the analyzer.
2. Install the Flush Fixture into the analyzer in the same way as the Reagent Pack.
3. Place the W-line of the fixture into an empty container.
4. Place the other tubing ends into a beaker of distilled water.
5. From the Ready/Not Ready screen, press Menu (soft key).
6. Select Flowpath Maintenance and press Enter.
7. Press Purge (soft key).
8. When the cycle ends, take all the tubings out of the distilled water. Leave the W-line in its container.
9. Repeat the purge with air.
10. When this cycle is completed, remove the flush fixture.
11. The pHOx Analyzer is now ready to be powered off for extended time.

A.6 Start Up Procedure

1. Insert the Reagent Pack and the Quality Control Pack.
2. Reinstall the pump tubing.
3. Power up the analyzer.
4. Perform normal fluid priming and biosensor maintenance.
5. Calibrate the analyzer.
6. Run QC per your normal procedures.

Stat Profile pHOx
Installation Check List

Model _____ Serial # _____ SMR(s) _____

DONE

Set Up Check Out

- ☐ Inspect Unit for Shipping Damage
- ☐ Remove Cover, Check all Cable Connections
- ☐ Fuses
- ☐ Correct Line Voltage
- ☐ Barometric Pressure
- ☐ Sensor Module Temperature

YES N/A

Operator Training Subjects

☐	☐	System Identificaion
☐	☐	Running an Analysis
☐	☐	Operational Status
☐	☐	Calibrating the Analyzer
☐	☐	Using and Handling Controls
☐	☐	Replacing Reagents and Paper
☐	☐	Troubleshooting
☐	☐	Flow Test and Flushing
☐	☐	Maintenance
☐	☐	Set Up

DONE

Instrument Check Out

- ☐ W/R Pump Tubing Harness
- ☐ Reagent Cartridge
- ☐ Control Cartridge (when available)
- ☐ Tubing Harness
- ☐ Electrode / Membranes
- ☐ SO_2 Sensor Module
- ☐ Software Card and Version
- ☐ Probe/Microsample Adapter
- ☐ W and R Lines

YES N/A

Troubleshooting Training Subjects

☐	☐	Solenoid Valve Tubing Incorrectly Seated
☐	☐	Water Test
☐	☐	Flow Blockage
☐	☐	Other _____
☐	☐	Other _____
☐	☐	Other _____

DONE

- ☐ Fill out and review PACE forms
- ☐ Review customer warranty or service financing coverage

The above checks have been performed on your NOVA analyzer as part of your INSTALLATION. We at NOVA BIOMEDICAL believe that you, our valued customer, are entitled to the highest quality support available. As part of this service, we are leaving a copy of this check list for your records. If any questions arise, feel free to contact us TOLL FREE at 1-800-545-NOVA.

Nova Biomedical
Dedicated to World Class Support

Nova Support Representative Date

Customer Signature Date

Nova Biomedical pHOx
Preventive Maintenance Check List

Model _____ Serial # _____ SMR _____

Mechanical Checkout

INSPECT	REPLACE	ADJUST	CLEAN	
☐	☐	☐	☐	Pump Assy
☐	☐	☐	☐	Sampler Assy
☐	☐	☐	☐	W & R Valve
☐	☐	☐	☐	Rotary Valve
☐	☐	☐	☐	Printer Assy

Electronic Checkout

INSPECT	REPLACE	ADJUST	CLEAN	
☐	☐	☐	☐	LCD Screen
☐	☐	☐	☐	Electronics Bay
☐	☐	☐	☐	Electrical Grounds
☐	☐	☐	☐	RS232 Connections
☐	☐	☐	☐	Software Version _____

Fluidic Checkout

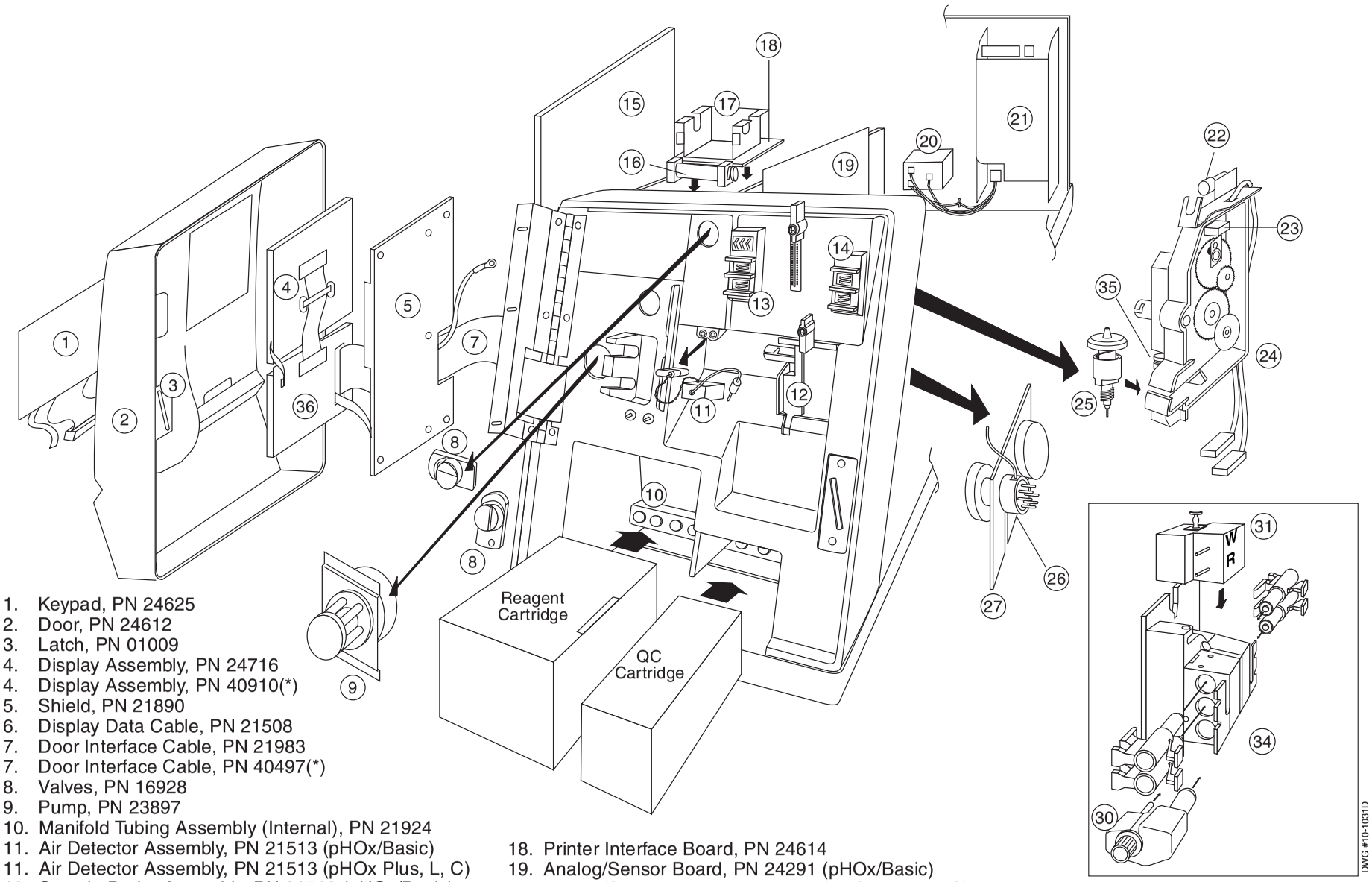
INSPECT	REPLACE	ADJUST	CLEAN	DONE	
☐	☐	☐	☐		Flowcell
☐	☐	☐	☐		SO_2 Sensor
☐	☐	☐	☐		Sensors (replace membrane, if applicable)
☐	☐	☐	☐		External Tubing
☐	☐	☐	☐		Internal Tubing
☐	☐	☐	☐		Fluids Bay
☐	☐	☐	☐		Fluid Fountain
☐	☐	☐	☐		Sample Probe
☐	☐	☐	☐		Capillary Adapter

The above checks have been performed on your NOVA analyzer as part of your scheduled PREVENTIVE MAINTENANCE service call. We at NOVA BIOMEDICAL believe that you, our valued customer, are entitled to the highest quality support available. As part of this service, we are leaving a copy of this check list for your records. If any questions arise, feel free to contact us TOLL FREE at 1-800-545-NOVA. The PM sticker placed on the upper, front corner of the left side cover indicates today's date, the month your next scheduled PM is due, the initials of the Nova Support Representative and the service report number.

Nova Biomedical
Dedicated to World Class Support

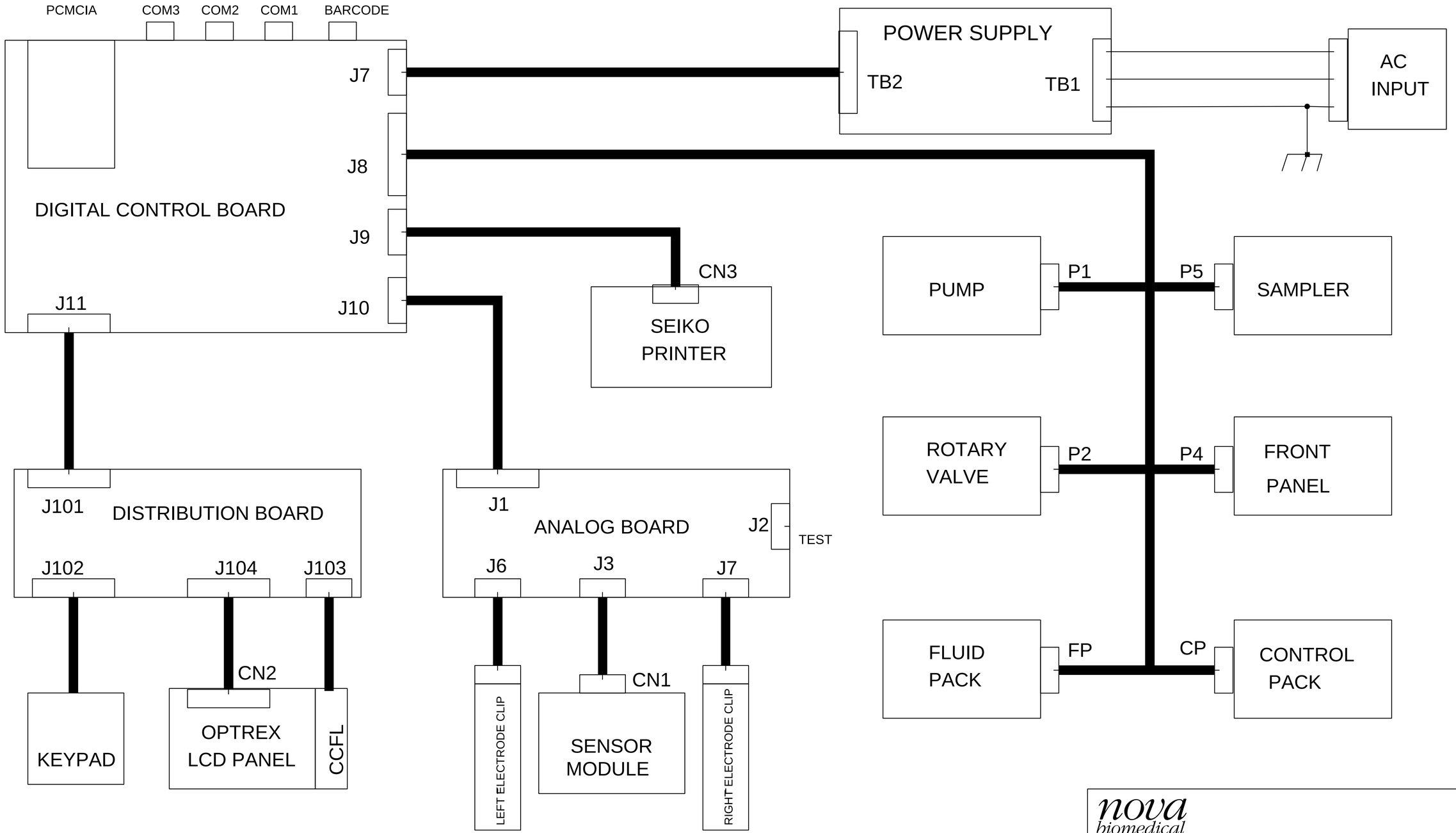
Nova Support Representative Date

Customer Signature Date



1. Keypad, PN 24625
2. Door, PN 24612
3. Latch, PN 01009
4. Display Assembly, PN 24716
4. Display Assembly, PN 40910(*)
5. Shield, PN 21890
6. Display Data Cable, PN 21508
7. Door Interface Cable, PN 21983
7. Door Interface Cable, PN 40497(*)
8. Valves, PN 16928
9. Pump, PN 23897
10. Manifold Tubing Assembly (Internal), PN 21924
11. Air Detector Assembly, PN 21513 (pHOx/Basic)
11. Air Detector Assembly, PN 21513 (pHOx Plus, L, C)
12. Sample Probe Assembly, PN 21519 (pHOx/Basic)
12. Sample Probe Assembly, PN 21519 (pHOx Plus, L, C)
13. Electrode Interconnect (Left) Board, PN 24719 (pHOx/pHOx Basic/BiopHOx only)
14. Electrode Interconnect (Right) Board, PN 24718 (pHOx/pHOx Basic/BiopHOx only)
15. Digital Control Board, PN 24292
15. Digital Control Board, PN 40797(*)
16. Printer Assembly, PN 24615
17. Paper Holder, PN 21841
18. Printer Interface Board, PN 24614
19. Analog/Sensor Board, PN 24291 (pHOx/Basic)
19. Analog/Sensor Board, PN 24291 (pHOx Plus, L, C)
20. Power Entry Module, PN 21716
21. Power Supply Assembly, PN 29200
22. Flowcell Lamp, PN 24717
23. Optical Detector, PN 24622
24. Sampler Assembly, PN 23899
25. Fluid Fountain, PN 24620
26. Optical Switch, PN 24613
27. Rotary Valve Assembly, PN 23898
30. SO2 Sensor Block, PN 21512
31. Reference Electrode, PN 21520(pHOx/Basic)
31. Reference, PN 21520(pHOx +,L,C)
34. Flowcell Module Assy, pHOx PN 24297, pHOx+ PN 27807 pHOx Plus L PN 34654, pHOx Plus C PN 34653
35. Capillary Adaptor, PN 21238
36. Door Distribution Board, PN 24727
36. Door Distribution Board, PN 40795(*)

NOTE: (*)Units Manuafactured after June 1, 2005



nova biomedical

Title: WIRING DOCUMENT
FOR PRODUCT: NOVA PHOX

Size	Drawing Number	Rev
D		

Do not scale drawing

Sheet 1 of 1

DWG #10-1087A

AC Mains Entry Module To Power Supply TB1

AC Line	Brown	1
AC Neutral	Blue	3
Earth Ground	Green/Yellow	5

Analog Board J3 to Sensor Module CN1

ADT1-E	Yellow	1
ADT1-M	Blue	2
THERMISTOR	Red	3
FPACK	White	4
AGND	Black	5
N.C.	---	6
HEATER+	Red	7
HEATER-	Brown	8
N.C.	---	9
N.C.	---	10

Digital Control Board J9 to Seiko Printer CN3

PV1	---	1
GND	---	2
PV2	---	3
PV2	---	4
PGND	---	5
PGND	---	6
P STB#	---	11
P DR1	---	12
P DR2	---	13
P DR3	---	14
P DR4	---	15
P DR5	---	16
P DR6	---	17
P DR7	---	18
P DR8	---	19
P BUSY	---	20
P ACK#	---	21
P ERR#	---	22
P PE	---	23
GND	---	24
P RESET#	---	25
P ONLINO	---	26
P ONLINI	---	27
P FEED#	---	28
P BFEED#	---	29
P NMI#	---	30
PV2	---	31
PV2	---	32
GND	---	33
PV1	---	34

Main Wire Harness J8 to Lamp P7

LAMP-	Red	1
LAMP+	Brown	2

Digital Control Board J11 to Distribution Board J101

GND	---	1
D LP	---	2
GND	---	3
D M	---	4
GND	---	5
D FLM	---	6
GND	---	7
D CP	---	8
GND	---	9
D DD0	---	10
GND	---	11
D DD1	---	12
GND	---	13
D DD2	---	14
GND	---	15
D DD3	---	16
GND	---	17
D SPARE	---	18
GND	---	19
D ENAVDD	---	20
D VEEN	---	21
D ENABKL	---	22
D YELLOW#	---	23
D GREEN#	---	24
D VCC	---	25
D VCC	---	26
D VCC	---	27
D VCC	---	28
KBY5#	---	29
KBY4#	---	30
KBY3#	---	31
KBY2#	---	32
KBY1#	---	33
KBY0#	---	34
KBX3#	---	35
KBX1#	---	36
KBX2#	---	37
KBX0#	---	38
SPCLK	---	39
DACLK	---	41
DADAT	---	42
SPKR-	---	43
SPKR+	---	44

Main Wire Harness J8 to Control Pack CP

TOUCH	Orange	1
N.C.	---	2
N.C.	---	3
GND	Black	4

Digital Control Board J10 to Analog Board J1

PGND	---	1
ANA V+	---	2
+5VANA	---	3
-5VANA	---	4
ANAGND	---	5
ANAGND	---	6
ANAGND	---	10
ANARXD#	---	12
ANATXD#	---	13
VCCPROT	---	14
GND	---	15
GND	---	16
INT7	---	18
HTRCTL#	---	19
FAIL#	---	20
$1N3313	---	22
PGND	---	24

Main Wire Harness J8 to Fluid Deck P4

VALVE1#	White	1
VALVE0#	Violet	2
VALVECOM	Black	3
N.C.	---	4
ADT1-E	Yellow	5
ADT1-M	Blue	6

Main Wire Harness J8 to Pump P1

PDM1	Red	1
PDM3	Yellow	2
PDM0	Black	3
PDM2	Grey	4

Main Wire Harness J8 to Sampler P5

SMD1	Yellow	1
SMD3	Red	2
SMD0	Black	3
SMD2	Grey	4
N.C.	---	5
N.C.	---	6

Main Wire Harness J8 to Rot Val P9

N.C.	---	1
N.C.	---	2
ROVHOME#	White	3
ROVLED	Red	4
GND	Black	5
GND	Black	6

Main Wire Harness J8 to Door Switch P6

DOORSW#	White	1
N.C.	---	2
PGND	Black	3

Digital Control Board J8 to Main Wire Harness

PGND	P9	Black	1
PGND	P6	Black	3
PMD1	P1	Red	5
PMD3	P1	Yellow	6
PMD0	P1	Black	7
PMD2	P1	Grey	8
VALVECOM	P4	Black	9
TOUCH	FP	Orange	10
SMD3	P5	Red	11
DOORSW#	P6	White	12
SMD2	P5	Grey	13
PGND	P10	Black	14
SMD1	P5	Yellow	15
GND	P10	Black	16
SMD10	P5	Black	17
PGND	FP	Black	18
RVD3	P2	Red	19
SAMPLED	P10	Red	20
RVD2	P2	Grey	21
ROVLED	P9	Red	22
HEATER+	P3	Red	23
HOME#	P9	White	24
DOORLED	---	N.C.	25
SAMHOME#	P10	White	26
HEATER-	P3	Brown	27
LAMP-	P7	Brown	28
GND	---	N.C.	29
LAMP+	P7	Red	30
VALVE1#	P4	White	31
RVD0	P2	Black	32
VALVE0#	P4	Violet	33
RVD1	P2	Yellow	34
PGND	P9	Black	2
PGND	---	N.C.	4

Power Supply TB2 to Digital Control Board J7

PGND	Black	1
+24VDC	Violet	2
POWER-FAIL	White	3
+5VDC	Red	4
GND	Black	5
+12VDC	Orange	6
GND	Green	7
-12VDC	Yellow	8

Main Wire Harness J8 to Fluid Pack FP

TOUCH	Orange	1
N.C.	---	2
N.C.	---	3
GND	Black	4

Distribution Board J102 to Membrane Keypad

KBY5#	---	1
KBY4#	---	2
KBY3#	---	3
KBY2#	---	4
KBY1#	---	5
KBY0#	---	6
KBX3#	---	7
KBX2#	---	8
KBX1#	---	9
KBX0#	---	10
G AN	---	11
G KA	---	12
Y AN	---	13
Y KA	---	14

Distribution Board J103 to Optrex Backlight CN1

COM	White	1
N.C.	---	2
N.C.	---	3
HOT	Black	4

Distribution Board J104 to Optrex LCD Panel CN2

D FLM	---	1
D LP	---	2
D CP	---	3
D M	---	4
VADJ	---	5
VCCS	---	6
GND	---	7
VEE	---	8
D DD3	---	9
D DD2	---	10
D DD1	---	11
D DD0	---	12
DISPOFF#	---	13

Main Wire Harness J8 to Rotary Valve P2

RVD1	Yellow	1
RVD3	Red	2
RVD0	Black	3
RVD2	Grey	4
N.C.	---	5
N.C.	---	6

Main Wire Harness J8 to Sampler P10

N.C.	---	1
N.C.	---	2
SAMHOME#	White	3
SAMPLED	Red	4
GND	Black	5
GND	Black	6

LOGIC ANALYZER TEST POINTS

CLOCK GENERATOR

MANUAL RESET

POWER ON RESET

BARCODE

install BARCODE pullup OR pulldown only
so software sees the right levels when nothing is connected

SYSTEM BUS BUFFERS

DIAGNOSTIC LEDS

"RST"

"ADS"

"DRV"

RTC / NVRAM

DS1644P

U35

DRAM CONTROLLER

ALTERA
Epm7128SQC100-7

SYSTEM DRAM

U28

MT8D132M-6

PATIENT DATA
STORAGE

AT29C010A-90JC

128K x 8

U37

J6

PCMCIA CARD CONNECTOR

CARD ACCESS

FUJITSU FCN565PO68G0231E4

FRAME OF PCMCIA

CONNECTS TO CHASSIS GND

IPCM PORT

J5

JTAG PORT

J10

ANALOG BOARD CONNECTOR

DRAM SELECTION

1MEG = No jumper
4MEG = No jumper
16MEG = Yes jumper

256K X 32, 1M X 32,
OR 4M X 32 SIMM DRAM

J7

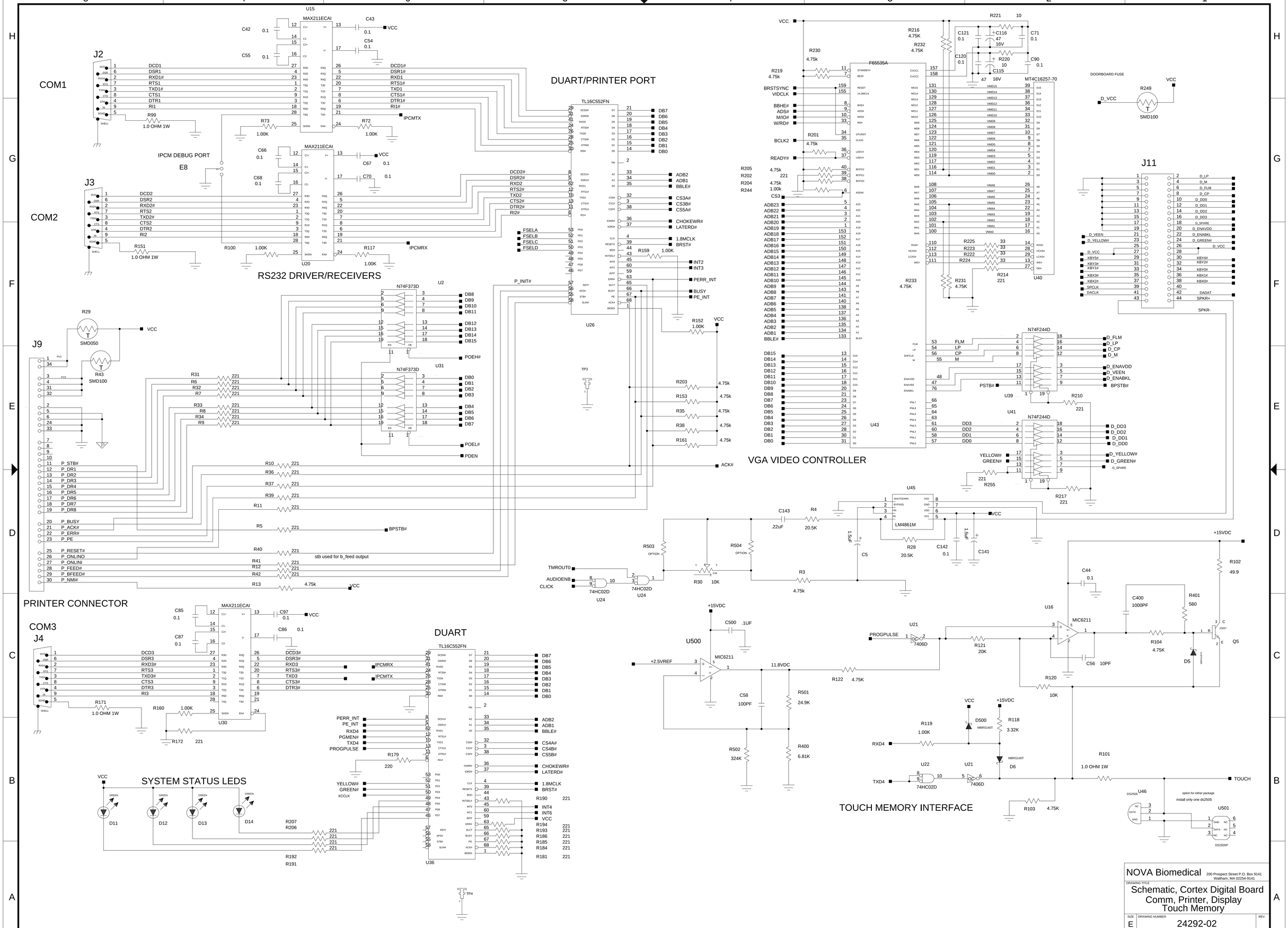
JUMPER SELECTS SIZE

LOCATE THESE PARTS
RIGHT NEXT TO J7
NET MUST CARRY 5A CURRENT

POWER SUPPLY CONNECTOR

NOVA Biomedical	200 Prospect Street P.O. Box 9141 Waltham, MA 02254-9141
DRAWING TITLE	Schematic, Cortex Digital Board Processor & Memory
SIZE	E
DRAWING NUMBER	24292-01
REV.	
DO NOT SCALE DRAWING	LAST MODIFIED ON: 10-5-1998 13:54
SHEET	1 OF 3

DWG #10-1071B



NOVA Biomedical	200 Prospect Street P.O. Box 9141 Waltham, MA 02254-9141
DRAWING TITLE	Schematic, Cortex Digital Board Comm, Printer, Display Touch Memory
SIZE	E
DRAWING NUMBER	24292-02
REV.	
DO NOT SCALE DRAWING	LAST MODIFIED ON 10-5-1998_16:11
SHEET	2 OF 3

DWG #10-1072B

SYSTEM CLOCK DIVIDER

KEYBOARD SCANNER

MOTOR CONTROLLER

XC5202-6PQ100C

FUNCTION SELECT

POWER GROUND

Pump Motor

PUMP and SAMPLER MOTORS:
RUN: 1300 MA

Sampler Motor

ROV Motor

ROTARY VALVE MOTOR:
RUN: 1700 MA

+2.5V REFERENCE

J8

HEATER DRIVER

HEATER CONTROL POLARITY

Jumper 1-2: normal sense (original state) Jumper 2-3: inverted sense (requires new sw)

LAMP DRIVER

LAMP IS T3/4 BULB 28V .17A

Local +15VDC

HOME DETECTORS

KEYBOARD CONNECTOR

UNUSED GATES

VALVE DRIVERS

VALVE BOOST

INSTALL ONE DIODE ONLY

NOVA Biomedical
200 Prospect Street P.O. Box 9141
Waltham, MA 02254-9141

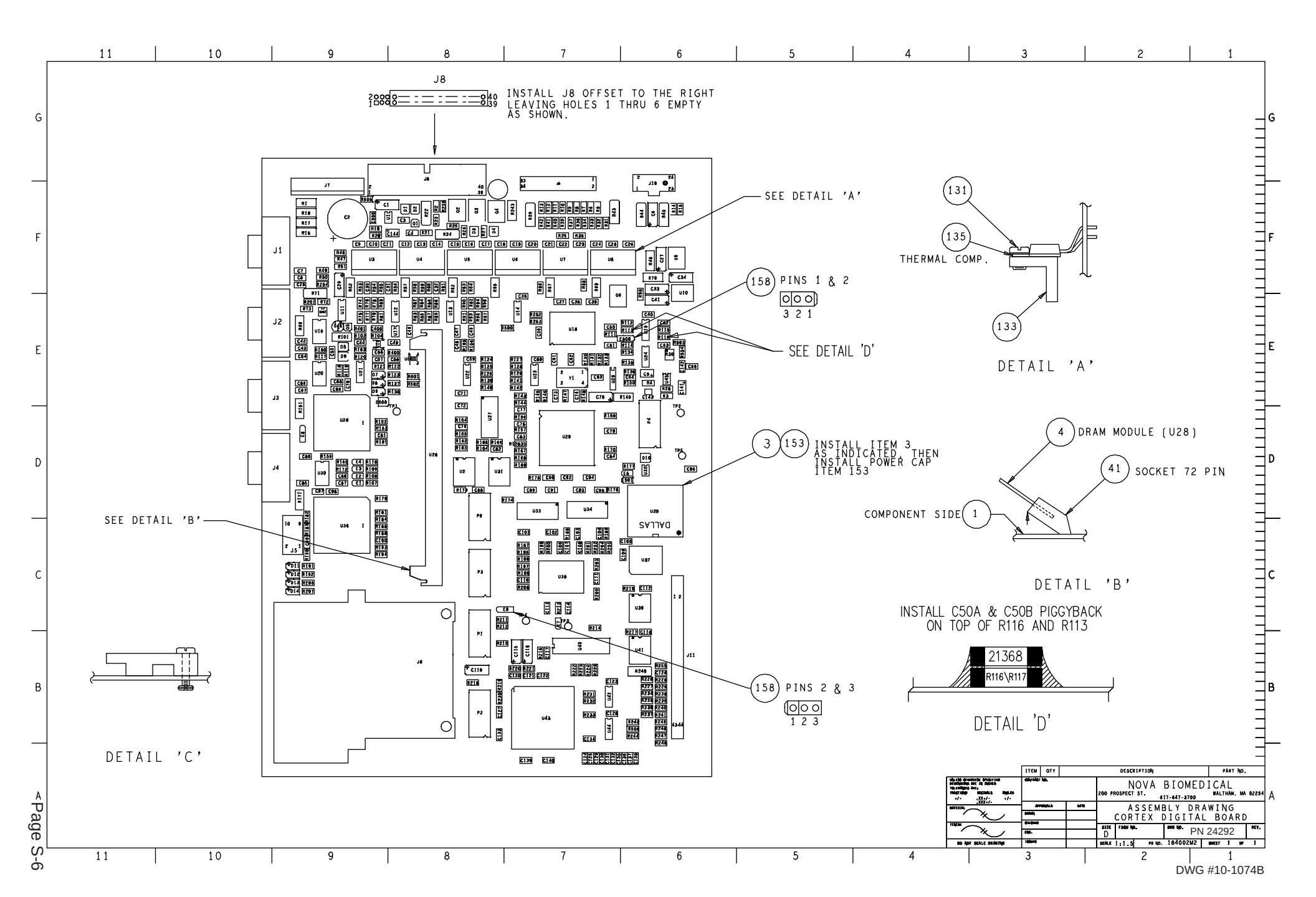
DRAWING TITLE
Schematic, Cortex Digital Board
Motor & Valve Drivers

SIZE	DRAWING NUMBER	REV.
E	24292-03	

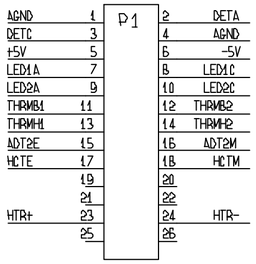
DO NOT SCALE DRAWING | LAST MODIFIED ON: 10-5-1998_13:57 | SHEET 3 OF 3

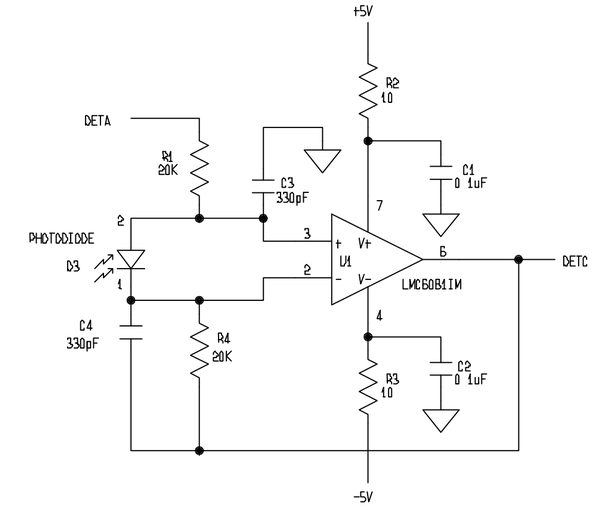
Page S-5

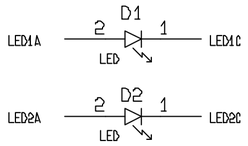
DWG #10-1073B

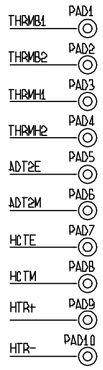

J8
INSTALL J8 OFFSET TO THE RIGHT
LEAVING HOLES 1 THRU 6 EMPTY
AS SHOWN.
SEE DETAIL 'A'
158 PINS 1 & 2
3 2 1
SEE DETAIL 'D'
SEE DETAIL 'B'
3 153 INSTALL ITEM 3
AS INDICATED, THEN
INSTALL POWER CAP
ITEM 153
158 PINS 2 & 3
1 2 3
131
135
THERMAL COMP.
133
DETAIL 'A'
4 DRAM MODULE (U28)
41 SOCKET 72 PIN
COMPONENT SIDE 1
DETAIL 'B'
INSTALL C50A & C50B PIGGYBACK
ON TOP OF R116 AND R113
21368
R116\R117
DETAIL 'D'
DETAIL 'C'
ITEM QTY DESCRIPTION PART NO.
NOVA BIOMEDICAL
200 PROSPECT ST. 617-647-3700 WALTHAM, MA 02254
ASSEMBLY DRAWING
CORTEX DIGITAL BOARD
SIZE D
DWG NO. PN 24292
REV.
SCALE 1:1.5
PD NO. 184002M2
SHEET 1 OF 1
DO NOT SCALE DRAWING

DWG #10-1074B

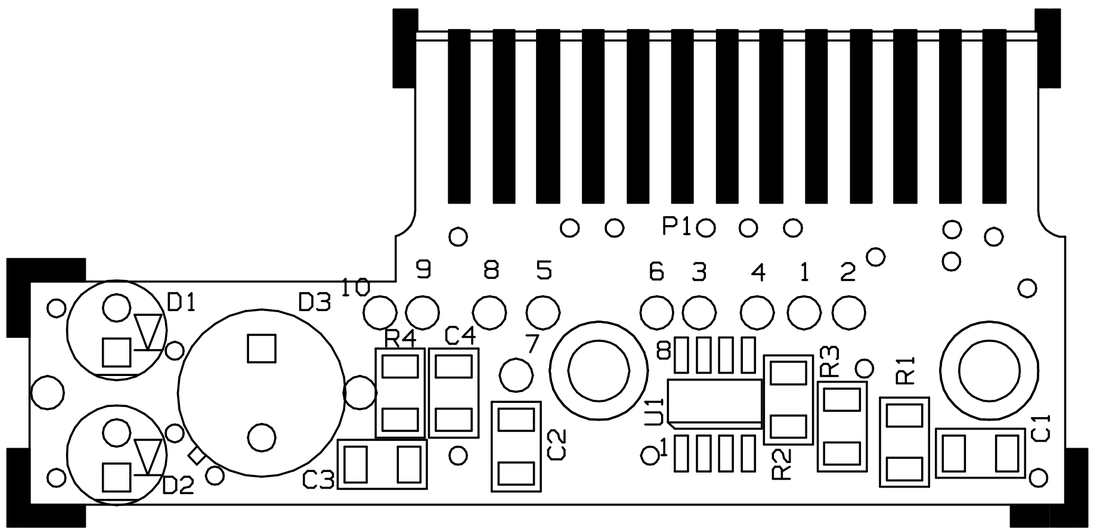






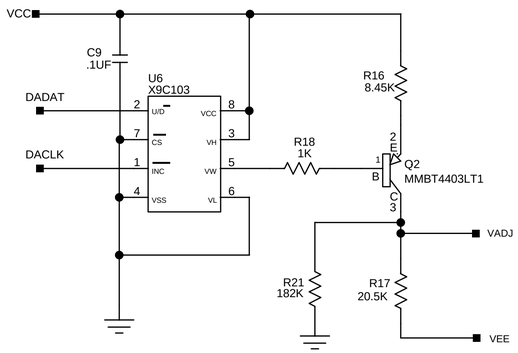


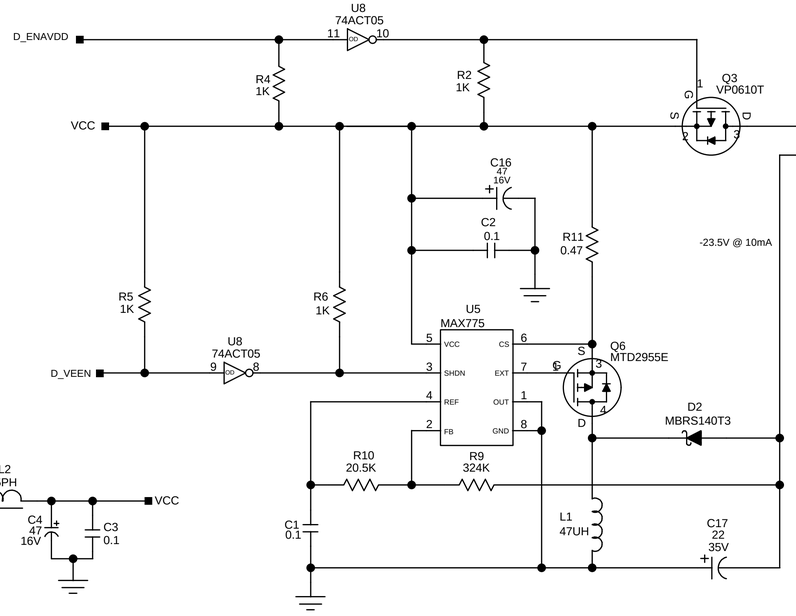
P10

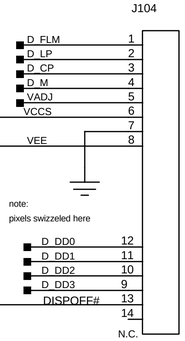


		Title: SCHEMATIC CORTEX SO2 BOARD	
Size: C	Drawing Number: PN 21642		Rev
Do not scale drawing		Sheet 01 of 1	

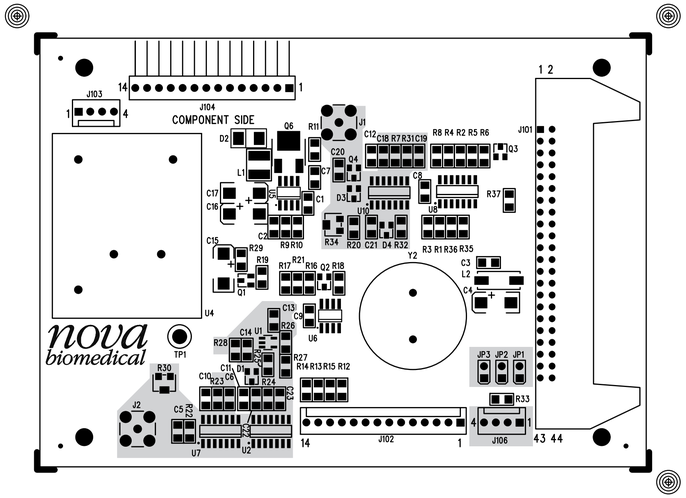
DWG #10-1075A



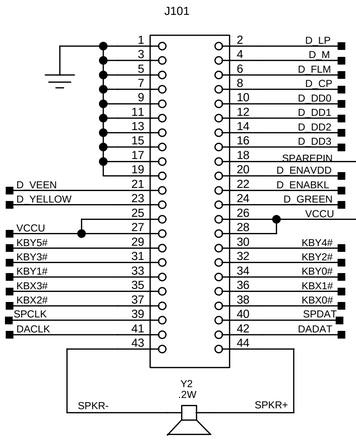


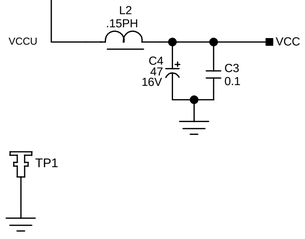


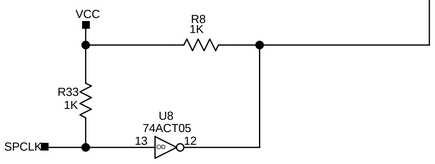
LCD DISPLAY

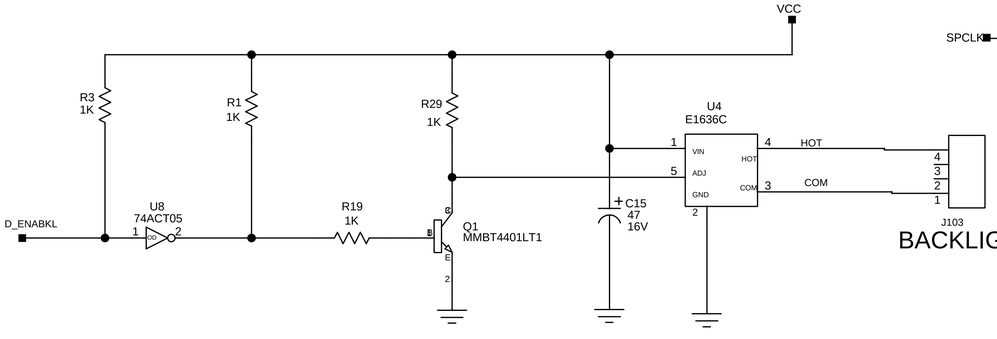


TOP COMPONENT SIDE SILK-SCREEN

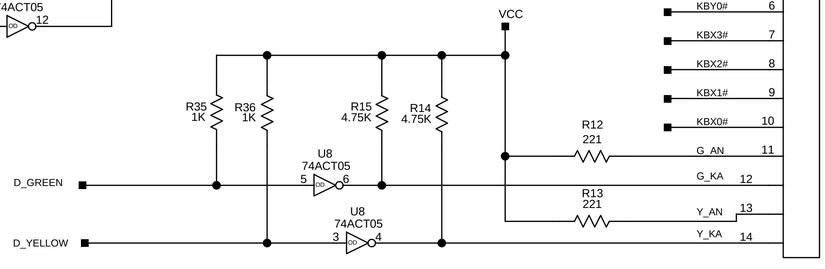




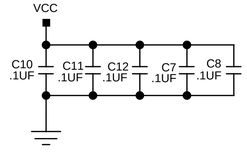




BACKLIGHT



KEYPAD



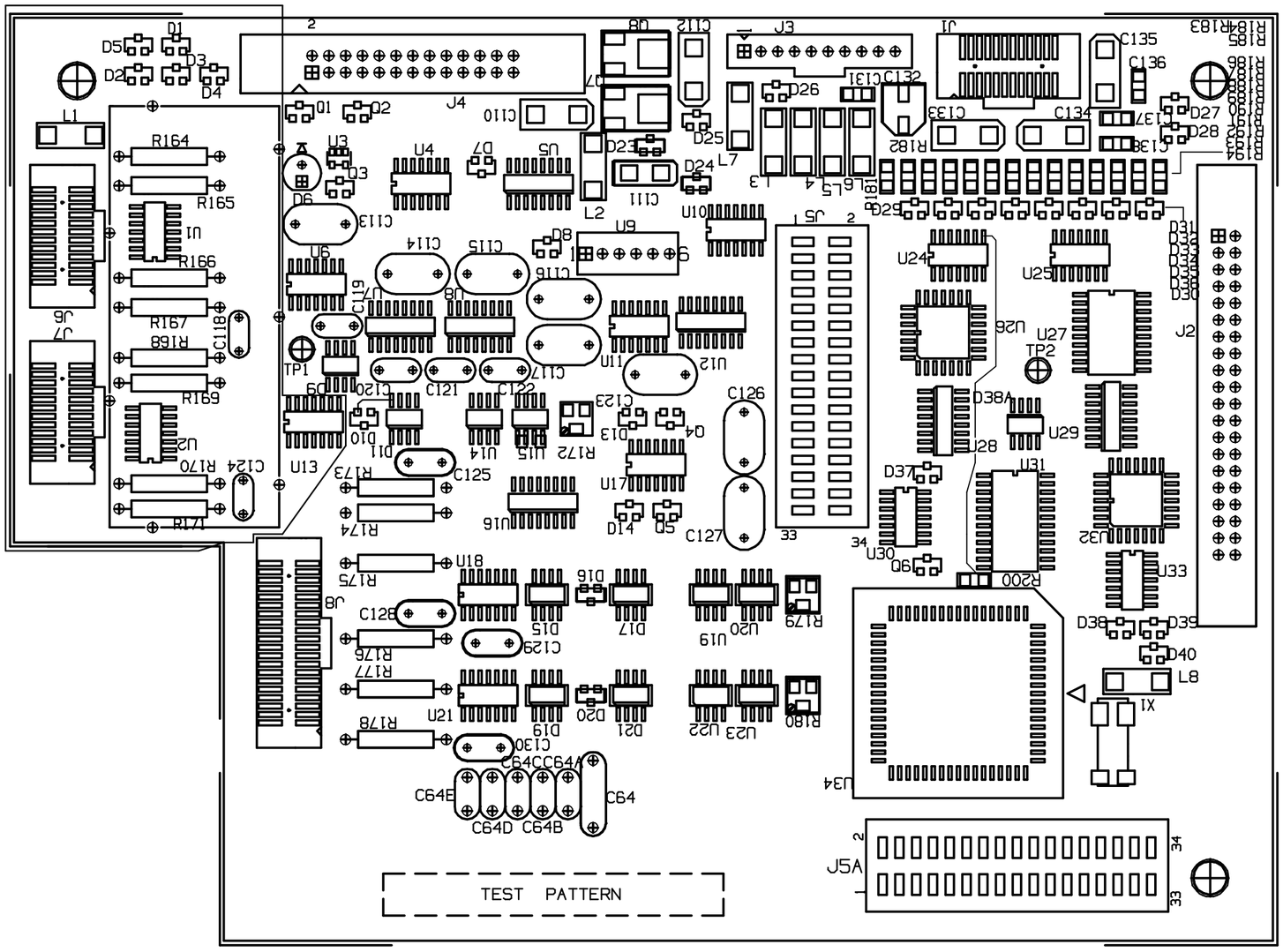
BYPASSING NOTES:

Place power supply filter as close to J101 as possible.

Bypass each chip with one 0.1uF from Vcc to Gnd unless bypass capacitors are explicitly shown.

NOVA Biomedical	200 Prospect Street P.O. Box 9141 Waltham, MA 02254-9141	
DRAWING TITLE: SCHEMATIC, CORTEX DISTRIBITION BOARD		
SIZE: D	DRAWING NUMBER: 24727	REV.
DO NOT SCALE DRAWING	LAST MODIFIED ON: 7-15-1998_12:16	SHEET 1 OF 2

DWG #10-1076B

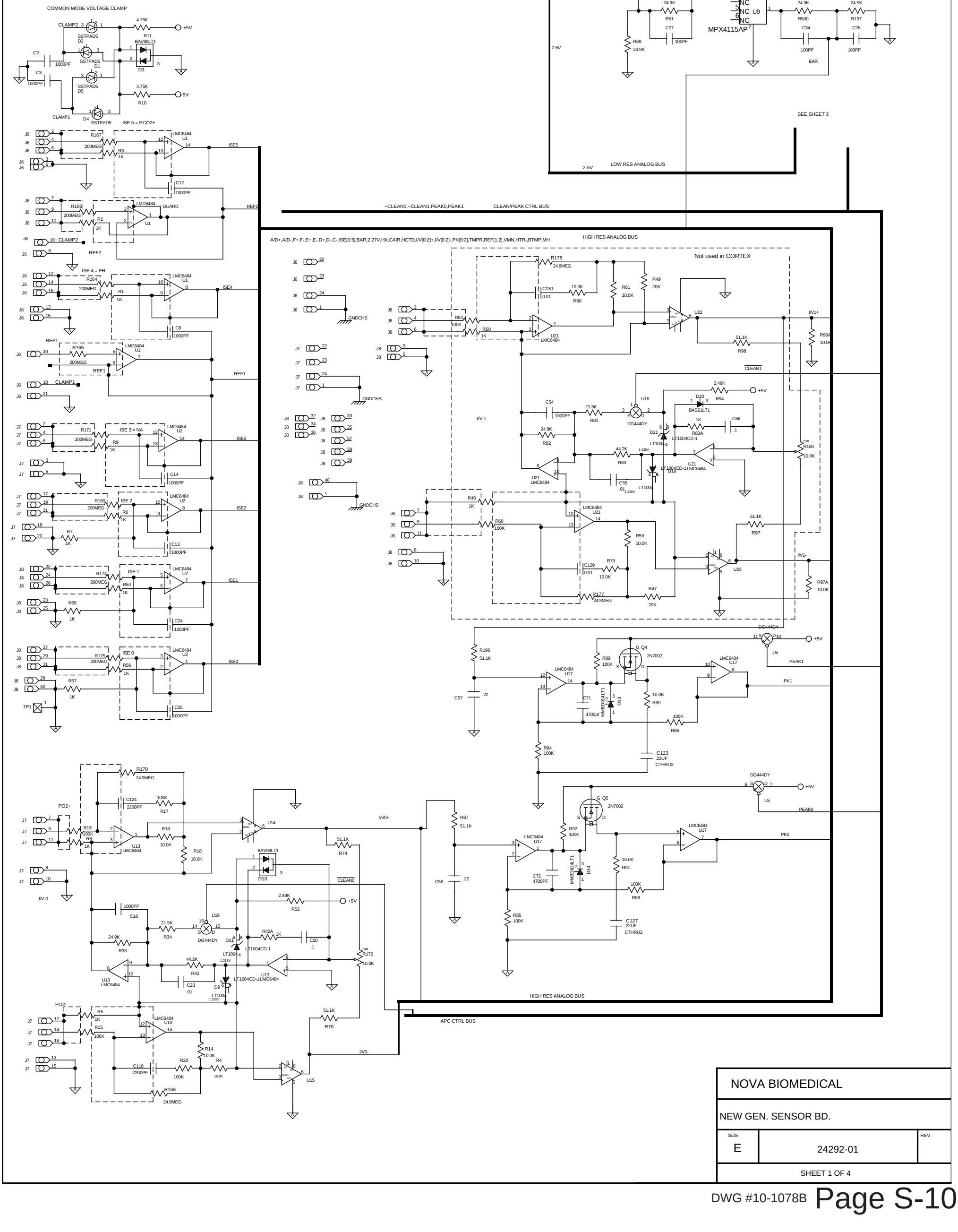


PCB ASSEMBLY DRAWING
ANALOG BOARD - CORTEX

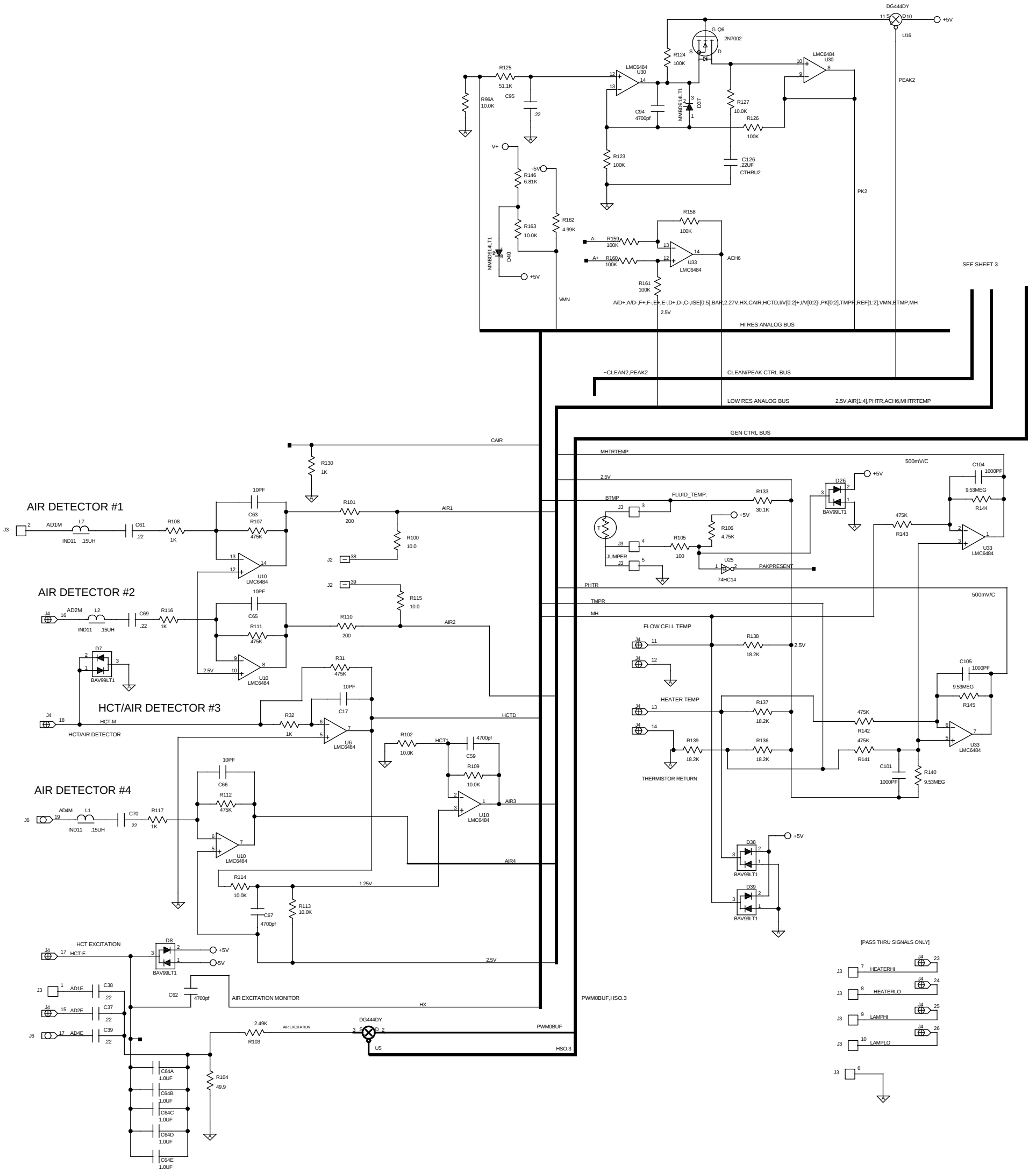
SIZE	DWG NO	REV
D	PN 24291	

DO NOT SCALE DRAWING | SHEET 1 OF 2

DWG #10-1077B



NOVA BIOMEDICAL		
NEW GEN. SENSOR BD.		
SIZE E	24292-01	REV.
SHEET 1 OF 4		



	NOVA BIOMEDICAL		
	NEW GEN. SENSOR BD.		
	SIZE E	24292-02	REV.
	SHEET 2 OF 4		

TO SHEETS 1 & 2

CLEAN/PEAK CTRL BUS

PEAK[0:2],~CLEAN[0:2]

HI RES ANALOG BUS

ANALOG MUX BUS

LOW RES ANALOG BUS

PHTR,ACH[0:2],ACH6,2.5V,AIR[1:4],MHRTEMP

PMUX[0:3],NMUX[0:3],NMUXENA[0:1],PMUXENA[0:3]

MOD CTRL BUS

GEN CTRL BUS

TO SHEETS 1 & 2

NOT INSTALLED IN CORTEX

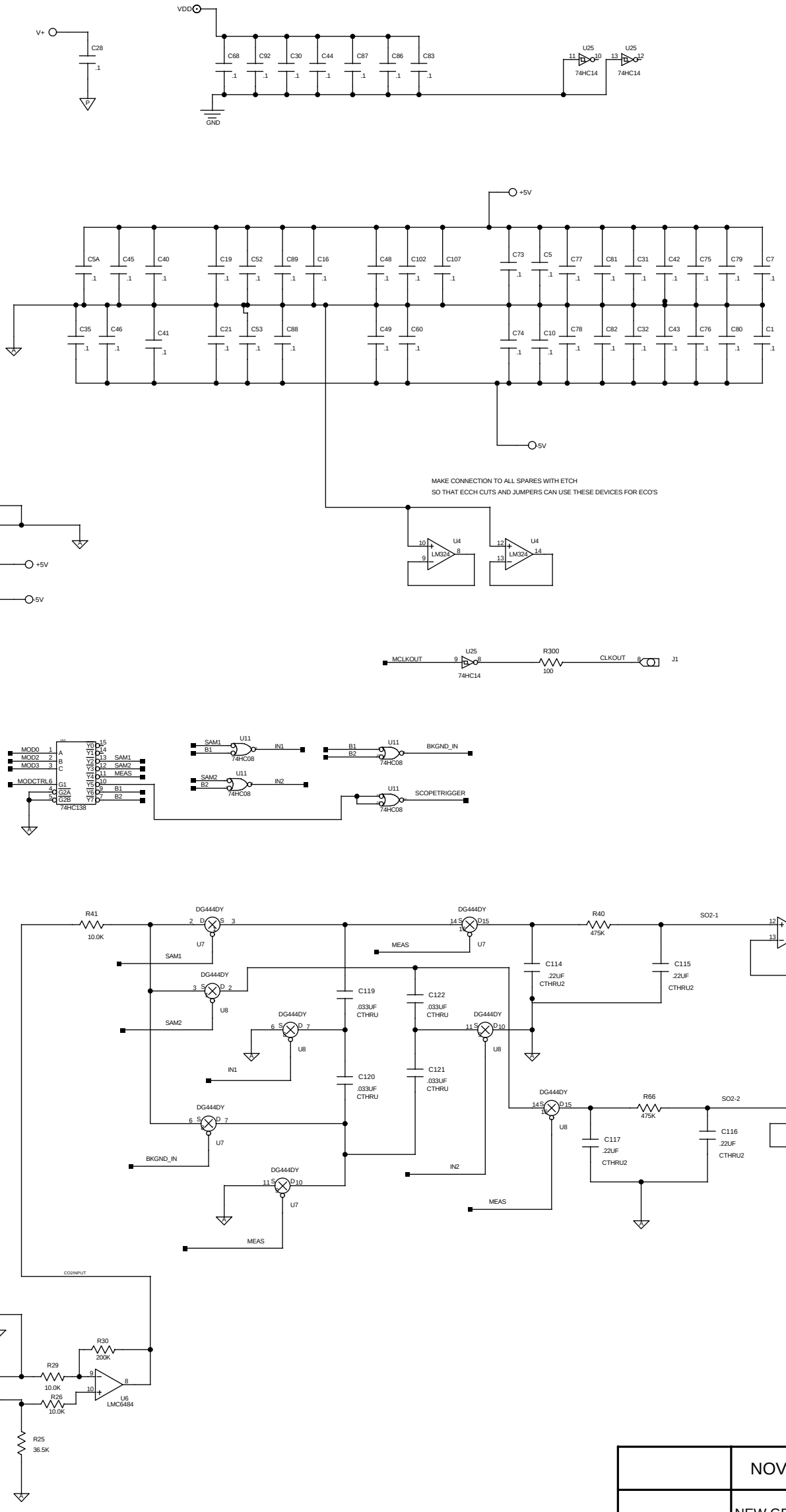
+5V MONITOR

ANALOG SUPPLIES

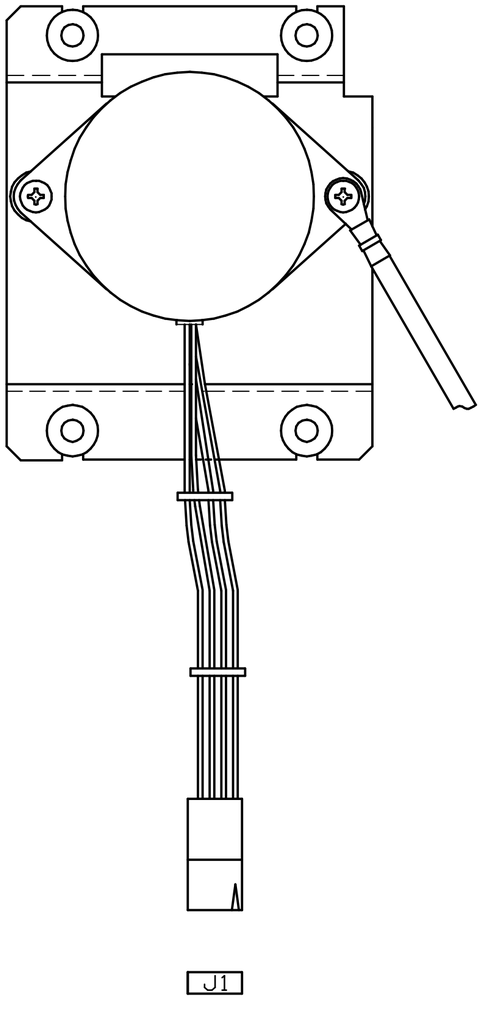
LOGIC SUPPLY

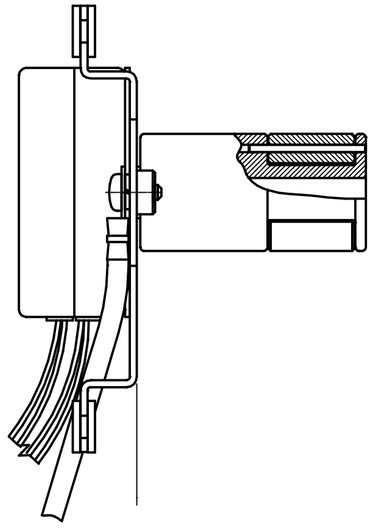
	NOVA BIOMEDICAL
	NEW GEN. SENSOR BD.
SIZE: E	24292-03
	SHEET 3 OF 4

REV.



	NOVA BIOMEDICAL		
	NEW GEN. SENSOR BD.		
	SIZE E	24292-04	REV.
	SHEET 4 OF 4		

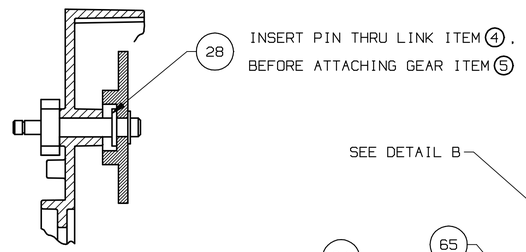




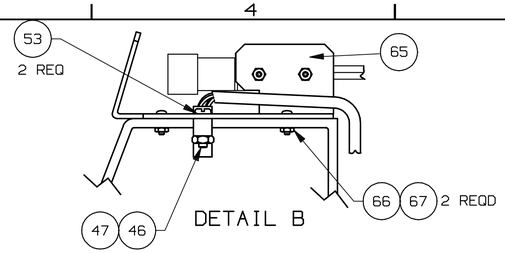
ASSY, PUMP pHOx		
SIZE C	DWG NO PN 23897	REV
DO NOT SCALE DRAWING		SHEET 1 OF 1

DWG #10-1082B

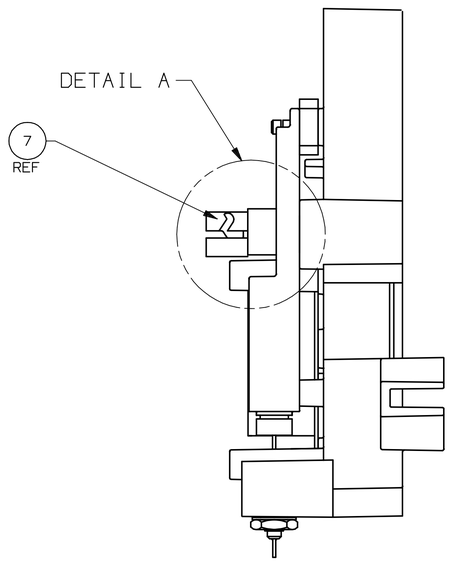
ITEM	P/N	DESCRIPTION
65	22745	Flowcell Lamp
5, 40, 58, 38	24628	Kit Sampler Gears
31	24622	Optosensor
8	24621	Motor, Sampler
52	20861	Fluid Fountain

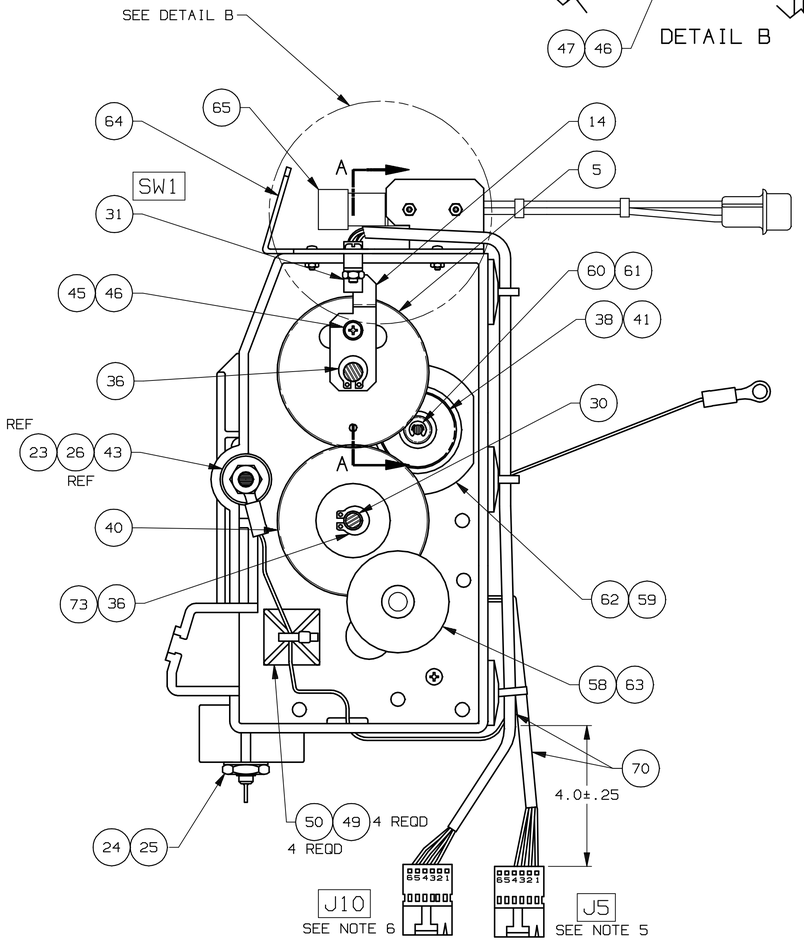


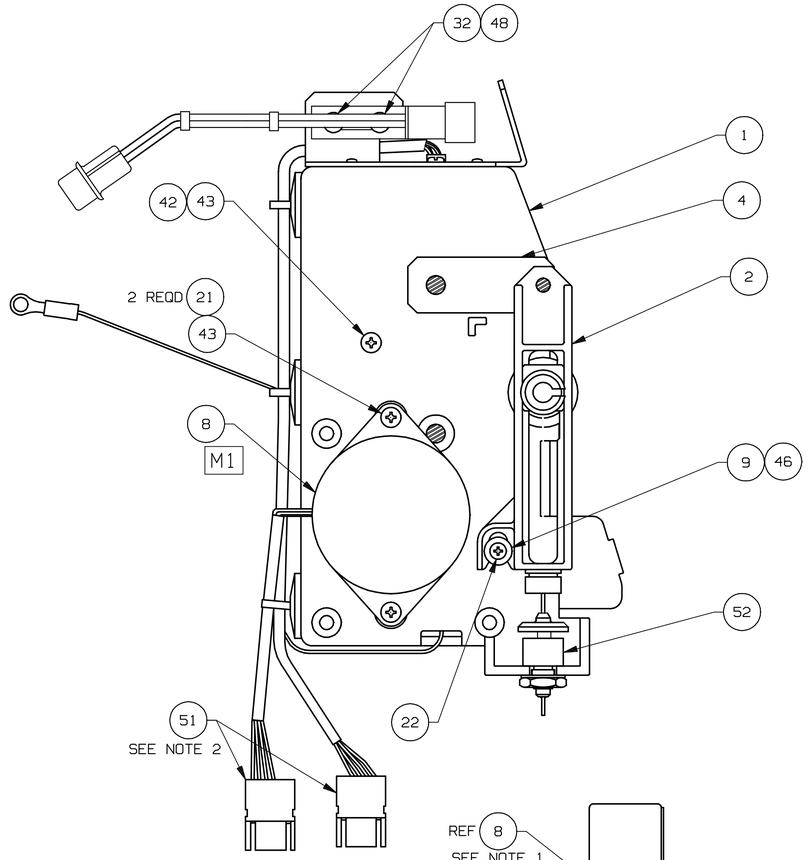
VIEW A-A

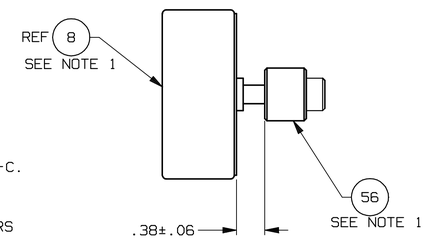


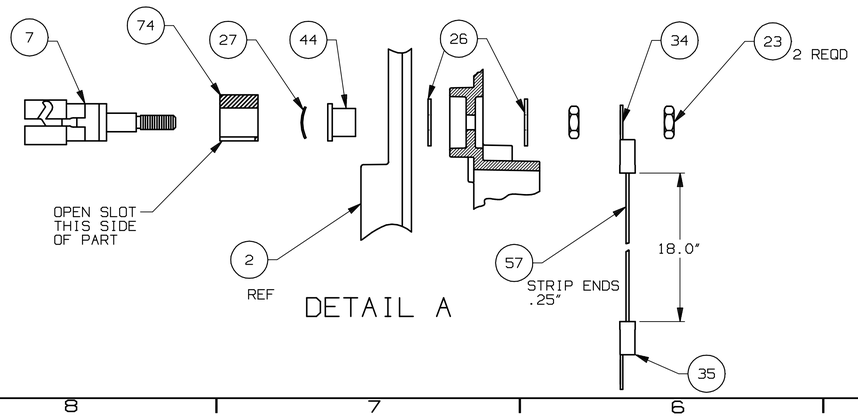
DETAIL B











DETAIL A

FROM	TO
M1-YEL	J5-1
M1-RED	J5-2
M1-BLK	J5-3
M1-GRY	J5-4
N/C	J5-5
N/C	J5-6
N/C	J10-1
N/C	J10-2
SW1-WHT	J10-3
SW1-RED	J10-4
SW1-BLK	J10-5
SW1-GRN	J10-6

NOTES:

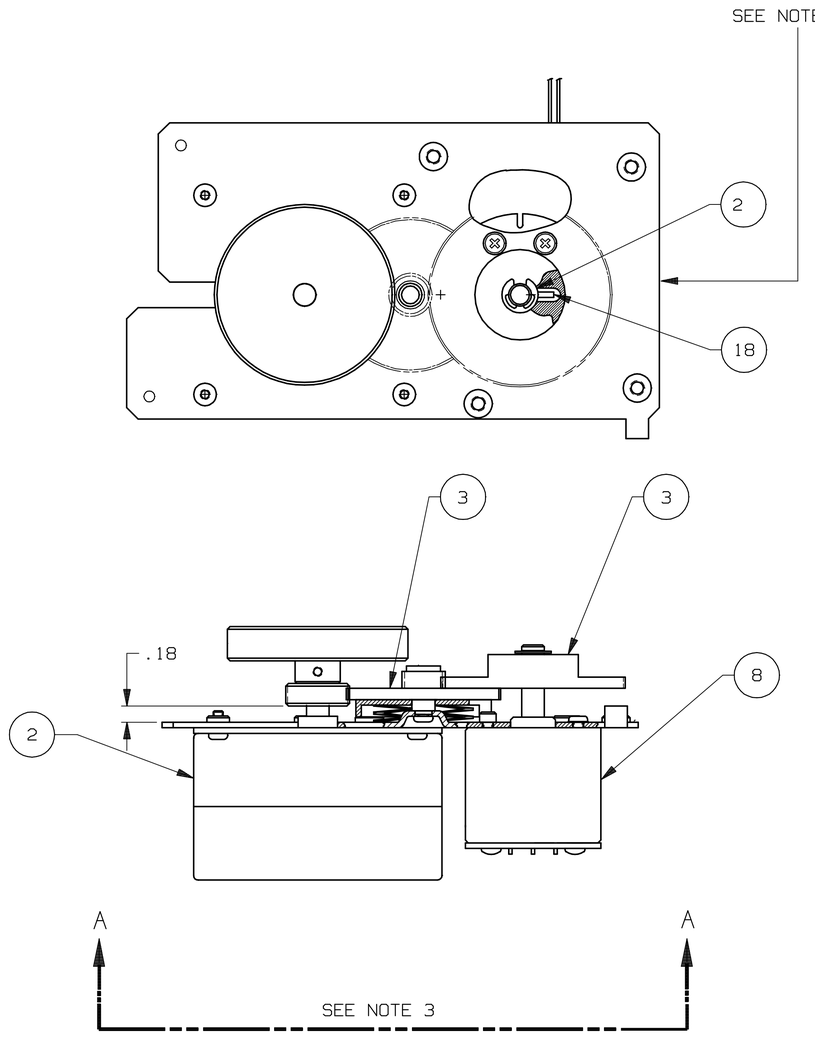
1. PRESS FIT PINION GEAR TO MOTOR SHAFT TO DIM SHOWN.
2. CRIMP PINS TO WIRE USING AMP CRIMP TOOL NO. 313807-1-C.
3. APPLY A LIGHT FILM OF SILICONE OIL ITEM 71 TO SHAFTS BEFORE INSERTING INTO HOUSING OR MOUNTING GEARS
4. APPLY A LIGHT FILM OF GREASE ITEM 72 TO TEETH OF GEARS
5. REMOVE PIN 6 FROM CONNECTOR AFTER CRIMPING WIRES.
6. REMOVE PIN 2 FROM CONNECTOR AFTER CRIMPING WIRES.

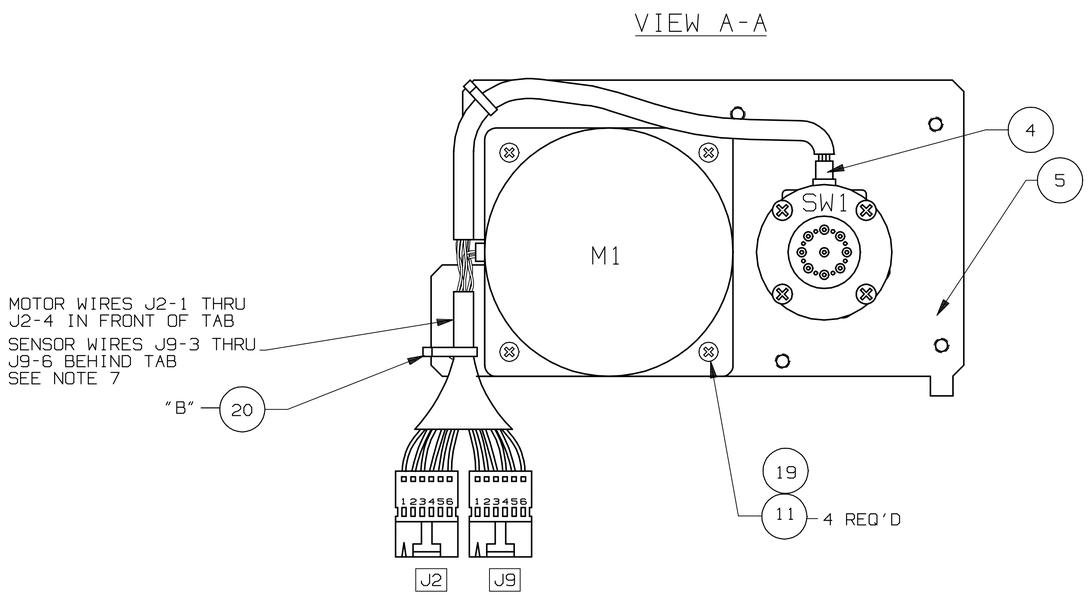
NOVA biomedical

ASSY, SAMPLER
PHOX

SIZE	DWG NO	REV
D	PN 23899	
DO NOT SCALE DRAWING		SHEET 1 OF 1

DWG #10-1083B





RUN LIST	
FROM	TO
M1 YEL	J2-1
M1 RED	J2-2
M1 BLK	J2-3
M1 GRY	J2-4
NC	J2-5
NC	J2-6
NC	J9-1
NC	J9-2
SW1 WHT	J9-3
SW1 RED	J9-4
SW1 BLK	J9-5
SW1 GRN	J9-6

ITEM	P/N	DESCRIPTION
2	24627	Motor Rotary Valve
3	24626	Kit Rotary Valve Gear
4	24613	Rep. Opto Sensor Rotary Valve
5	24624	Rep. Kit Ceramic Rotary Valve

NOTES:

1. ALIGN SLOT OF VALVE SWITCH AS SHOWN PRIOR TO ASSEMBLING ITEM 8 AS SHOWN.
2. DO NOT TIE WRAP MOTOR AND SENSOR LEADS TOGETHER EXCEPT AT POINT "B".
3. VACUUM TEST VALVE AT EACH FLUID POSITION AT 200mmHg. PRESSURE CHANGE SHALL NOT EXCEED 3mmHg IN 10 SECONDS.
4. CHECK THAT VALVE REACHES EACH POSITION UNDER ELECTRONIC CONTROL. THIS TEST TO BE DONE IN CONJUNCTION WITH LEAK TEST OF NOTE 8.

nova biomedical 200 Prospect Street Waltham, MA 02454-9141

ROTARY VALVE
DRIVE ASS'Y

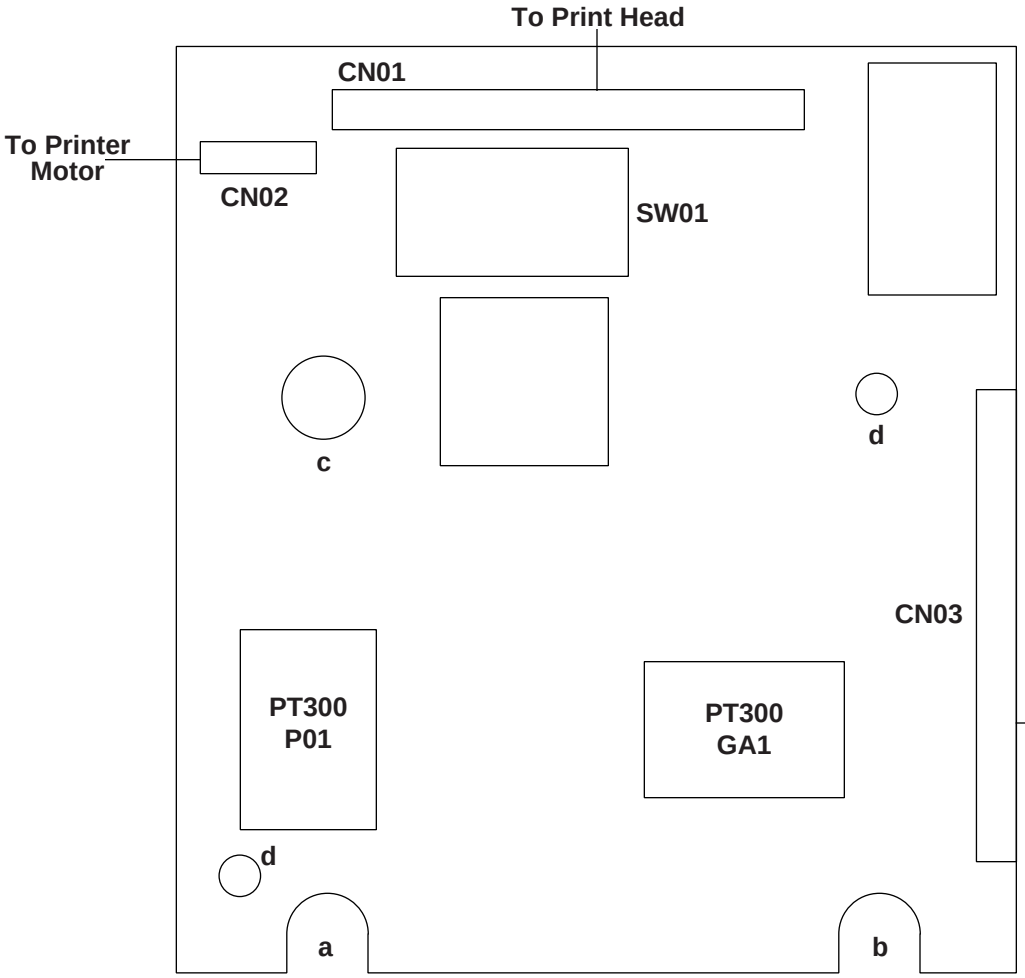
SIZE	DWG NO	REV
D	PN 23898	
DO NOT SCALE DRAWING	SHEET 1 OF 1	

DWG #10-1084B

nova biomedical

SPECIFICATION SHEET

TITLE	SIZE	DWG.NO.	REV
PRINTER INTERFACE IF3001 SEIKO	A		
	P/N 24614	SHT 1 OF 1	



CN01: Head flexible printed circuit connector

CN02: Motor control connector

CN03: Input/Output control connector

SW01: Function switch

a, b: Position selection notches for mounting to the LTP3245

c: Holes for mounting to the LTP3245

d: Two holes for mounting to the outer case (or frame)

NOTE: CN01: Lift white plastic part to release print head flat cable

REV	ECO#	APPROVED DRP/CO-DRP/DATE	EFFECTIVE ECO MGR/DATE	REV	ECO#	APPROVED DRP/CO-DRP/DATE	EFFECTIVE ECO MGR/DATE	For Doc.Cntrl Use Only Disk No.

DWG #10-1085B

nova biomedical

SPECIFICATION SHEET

TITLE
POWER SUPPLY UNIVERSAL INPUT
5+/-12 24Vo

SIZE	DWG.NO.	REV
A		
P/N 24720	SHT 1 OF 1	

INPUT: **J1** AMP P.C.B. HEADER P/N 640445-5

PIN 1)	AC LINE	**TB1**	
PIN 2)	N/C	PIN 1)	AC LINE
PIN 3)	AC NEUTRAL	PIN 2)	AC NEUTRAL
PIN 4)	N/C	PIN 3)	AC GROUND
PIN 5)	AC GROUND		

SIGNALS: **J2** AMP P.C.B. HEADER P/N 640456-4

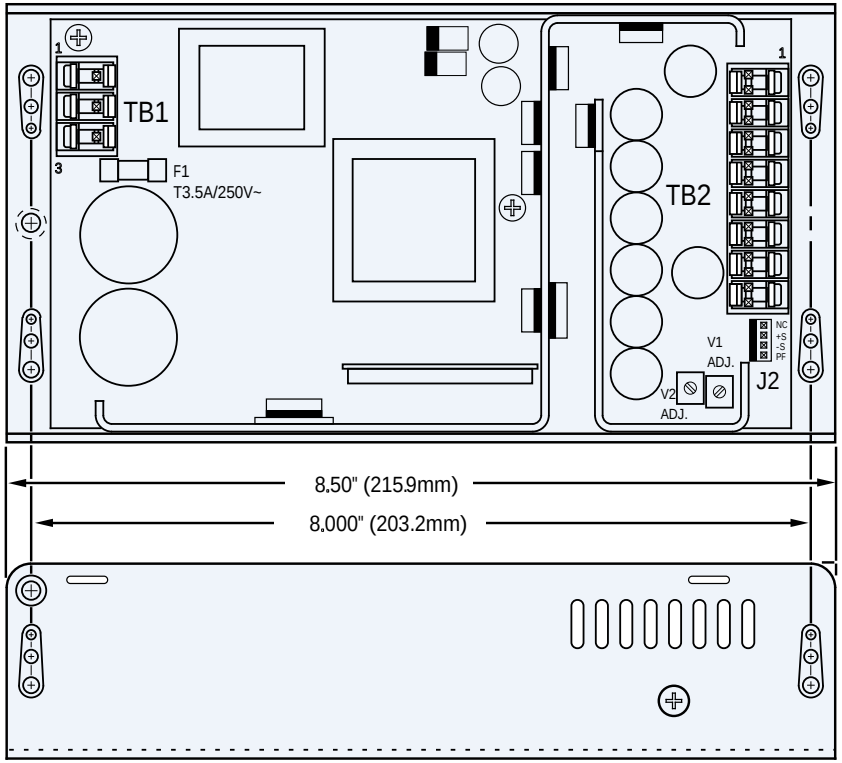
PIN 1)	N/C	PIN 3)	-SENSE
PIN 2)	+SENSE	PIN 4)	POWER FAIL

OUTPUT: **J3** AMP P.C.B. HEADER P/N 1-640445-6

PIN 1)	OUTPUT #4	PIN 14)	OUTPUT #1
PIN 2)	OUTPUT #4	PIN 15)	OUTPUT #1
PIN 3)	OUTPUT #3	PIN 16)	OUTPUT #1
PIN 4)	OUTPUT #3		
PIN 5)	OUTPUT #2	**TB2**	
PIN 6)	OUTPUT #2	PIN 1)	OUTPUT #4
PIN 7)	COMMON	PIN 2)	OUTPUT #3
PIN 8)	COMMON	PIN 3)	OUTPUT #2
PIN 9)	COMMON	PIN 4)	COMMON
PIN 10)	COMMON	PIN 5)	COMMON
PIN 11)	COMMON	PIN 6)	COMMON
PIN 12)	COMMON	PIN 7)	OUTPUT #1
PIN 13)	COMMON	PIN 8)	OUTPUT #1

NOTE: 5A MAXIMUM RECOMMENDED CURRENT PER CONNECTOR PIN

WEIGHT: 2.3 LBS. MAX.



Model (Note A)	Output	Output Voltage	Minimum	Output Current Maximum (Note C)	Maximum (Note D)	Peak	Noise P-P	Total Regulation (Note B)
GPx130D	1	+5V	3A	16A	20A	25A	50mV	2%
	2	+24V	0A	3.5A	3.5A	5A	240mV	2%
	3	-12V	0A	1.2A	1.2A	1.5A	120mV	3%
	4	+12V	0A	1.2A	1.2A	1.5A	120mV	3%

REV	ECO#	APPROVED DRP/CO-DRP/DATE	EFFECTIVE ECO MGR/DATE	REV	ECO#	APPROVED DRP/CO-DRP/DATE	EFFECTIVE ECO MGR/DATE	For Doc.Cntrl Use Only Disk No.

DWG #10-1086A